VETERINARY MEDICINE

January, 1933

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No. 1
VOL. XXVIII

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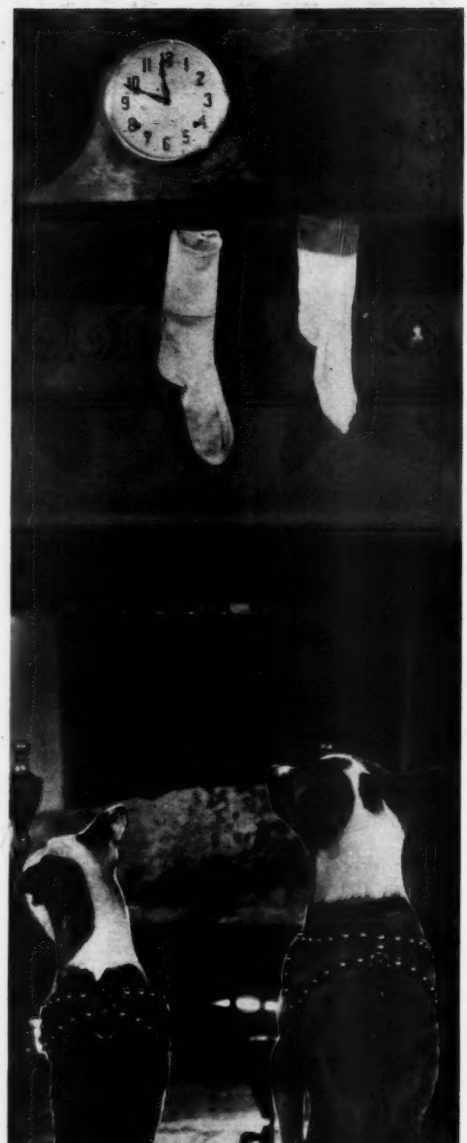

Forestry Farrell

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Yakimoff records the occurrence of two types of coccidia in a cat in Leningrad which he identified as *Isopora felis* and *I. rivolta*.

Jansen reports a peracute outbreak of disease among 700 ducks with a mortality of 10 per cent. Fowl cholera and duck plague were excluded. Examination of eight birds revealed an enormously heavy infestation with coccidia. Chemical analyses for poisons yielded negative results.

A German abortion commission for the campaign against the diseases of breeding animals states live vaccines should be used only on heifers and non-pregnant cows and then only in herds in which more than 10 per cent of the animals are infected. Heifers should not be bred for at least three months after being vaccinated nor cows for a period of six weeks.

Boyd reports an outbreak of amoebic dysentery among a pack of hounds in India. The symptoms were diarrhea with the passage of blood stained mucous. Postmortem examination showed the lesions confined to the large intestine, which was congested and in some cases eroded through the mucous membrane. One of the kennel assistants was found to be passing cysts in his feces. He was treated with emetine and the appearance of new cases in the hounds ceased.

Schwartz fed 25 dogs and six cats doses of the larvae *Ancylostoma caninum* at repeated intervals over a prolonged period. The course of the infestation as determined by the egg count, hemoglobin content of the blood and recovery of adult worms passed in the feces, are summarized as follows:

"In the six cases of heavy infestation the egg count rose rapidly during the first three months to a peak of several million eggs per day. The dogs became very anemic, the hemoglobin dropping as low as 25 per cent. Two dogs succumbed to the heavy burden of parasites but in four others a crisis occurred at this point and the egg count suddenly dropped to a comparatively low level even though large doses of larvae were still being given. At the same time large numbers of adult worms were passed in the feces and the hemoglobin gradually rose to normal. The fact that at the height of their infections these dogs not only resisted the development of more larvae but also threw off the majority of the worms already established is interpreted as an immunity reaction on the part of the host. This immunity was not absolute because two of the dogs after losing their infestations were subsequently given second and even third infestations which were thrown off in the same manner and more rapidly than the first.

During the last eight years, over 30,000 persons have been vaccinated against Rocky Mountain spotted fever (typhus), according to the U. S. Public Health Service. The vaccination is effective in preventing the disease, which is widespread over the northwestern part of the United States. The disease is transmitted from animals to man by the bite of ticks. The use of the vaccination is limited to persons whose occupations necessarily expose them to tick bites.

FAKER FINED FOR FAKE ABORTION "CURE"

Interstate shipment of a yellow solution consisting chiefly of water, but containing some carbolic acid, table salt, chlorine and sugar, and recommended as a remedy for contagious abortion of cattle, cost John W. Froberg, Valparaiso, Ind., a fine of $200 and costs in the Federal court for northern Indiana. The government alleged that the preparation was falsely and fraudulently labeled under the Federal food and drugs act. Froberg, under the name of "Dr. W. A. Bozarth," shipped the fake abortion remedy to consignees in Fond du Lac, Wis., and Armington, Ill. The government seized consignments of the goods and Froberg pleaded guilty to the charge of misbranding.

The government in recent years has found and seized scores of abortion nostrums. Most of these consisted essentially of medicated colored water, colored table salt, table salt with carbolic acid, brown sugar and bran, creosote, or drugs which act as irritants or vascular stimulants. Some of the preparations seized were simple and inexpensive drugs disguised in different ways. Others were mineral mixtures with or without drugs of any kind.

A vigorous four-year campaign has driven most of the falsely and fraudulently labeled abortion preparations from the market or has forced manufacturers to revise their labels so as to eliminate claims relating to the disease.

Few pathogenic organisms show the ready adaptability of *Bacterium tularense* to varying host and environmental conditions. This is indicated by the diverse and unusual means by which tularæmia infection can be acquired by man, and by the several vectors of wide taxonomic distribution which are capable of natural or experimental transmission of the disease. Of the several groups of arthropods known or suspected to be concerned in the transmission of tularæmia, present evidence indicates that ticks are the most important both from the standpoint of the maintenance of infection in nature and its transfer to man. Among biting insects, however, one species is a proved mechanical carrier, several more having suitable host relationships have been shown experimentally to be potential transmitters, while still others are suspected agents because of circumstantial data. Mosquitoes are among the last group.—*Public Health Reports.*

Brunett reports that in a pen containing two non-reacting cocks, thirteen reacting hens and twelve non-reacting hens, there was no evidence as shown by the agglutination test that the transmission of pullorum infection occurred, although the birds were kept together for nine months. In another experiment in which fourteen reacting and fourteen non-reacting hens were used, one bird was found to have contracted infection. Brunett believes that pullorum infection spreads among adult fowl but that the rate of spread is not so rapid as it is generally assumed to be.

Tullberg obtained two types of diplococci from cases of bovine mastitis. One type was virulent for mice, the other was not. A live vaccine was prepared from the virulent type and injected subcutaneously and intravenously into two cows from a mastitis free farm. Subsequently, intramammary injections of the same organism were made into these two cows and into two controls. Mastitis developed in all four animals, but was more severe in the controls. A further test furnished additional evidence that the vaccine possesses protective properties.

According to an investigation by the U. S. Public Health Service, children receiving predominantly raw milk suffer a higher incidence of diphtheria, scarlet fever, intestinal disturbances, and rickets than do children receiving heated milk only.

That there is no significant difference between the average weight of children who had received nothing but heated milk and the average weight of children who have received raw milk, is shown by an investigation made by the U. S. Public Health Service.

The growth-promoting capacity of pasteurized milk plus the supplemental diet received by the average American child of ten months to six years of age, is not measurably less than the growth promoting capacity of raw milk plus the supplementary diet received by the average American child of the same age.

There has been a rapid increase in the percentage of milk pasteurized in the United States during the past 30 years. From the beginning of the twentieth century to the present time, the percentages of milk pasteurized in American cities having a population of 10,000 or over, has increased from a negligible figure to 87.5 per cent of the total liquid milk consumed.

TICK QUARANTINE AREA REDUCED

Further progress in eradicating cattle ticks from the areas in the South still infested with this disease-carrying parasite is recorded in an order signed by R. W. Dunlap, Acting Secretary of Agriculture, to become effective December 5, 1932. This order removes the Federal quarantine from 20,290 square miles of territory in Arkansas, Florida, and Texas, and is recognition of progress, chiefly during the active tick eradication season of 1932. All of Arkansas is now released from tick quarantine. Parts of Florida, Louisiana and Texas are still under quarantine.

Gmelin is of the opinion, as a result of examinations of eyes from cases of periodic ophthalmia in the horse, that the condition is not due to infection of any kind, but is in the nature of an anaphylactic phenomenon. It is thought possible that parasitic invasions of the intestines are connected with it. If parasitic infestations are in some way connected with moon blindness in horses the treatment of hundreds of thousands of horses under the horse parasite control projects under way in various states should reveal the nature of this connection.

MARKET MILK IN CONNECTICUT

Two hundred and forty-four official samples of milk were submitted by the Dairy and Food Commissioner. About 60 per cent of these were not found adulterated. Roughly 20 per cent were adulterated by watering, or skimming, or both, and the remainder were below standard in some particular.

The distribution of samples is given in the following summary.

Summary of Inspection

	Number of Samples	Per Cent
Not found adulterated	142	58.2
Adulterated by watering	20	8.2
Adulterated by skimming	29	11.9
Adulterated by skimming and watering	1	0.4
Below standard:		
in solids and solids-not-fat	24	9.8
in solids and fat	7	2.9
in solids, fat and solids-not-fat	21	8.6
Totals	244	100.0

It should be noted that the relatively large proportion of adulterated samples can not be taken as an indication of the general run of market milk furnished to consumers in this State, because in most cases the samples collected by the inspectors were taken on complaints of local health officers or milk inspectors where some reason to question the character and quality of milk had arisen.—Connecticut Experiment Station Bulletin 341.

The County Agent Problem

AT THE request of the American Veterinary Medical Association, a hearing was granted the veterinary profession by the House of Representatives' Committee on Investigation of Government Competition with Private Business—The Shannon Congressional Committee.

The special Committee on Agricultural Extension Service of the A. V. M. A. together with a considerable number of witnesses, appeared before the Shannon Committee in Chicago, November 14, 1932. Because of the many interests desiring a hearing before that Committee and lack of time to hear all witnesses, it was agreed that the A. V. M. A. Committee should submit a single statement to which all witnesses would subscribe and such supporting testimony as the witnesses cared to place before the Congressional Committee.

The general statement for the A. V. M. A. Committee was made under oath by the Editor of this magazine. The statement submitted by the veterinarians is comprehensive in scope, comprising more than 30 pages of "legal size" manuscript. It deals with the whole field of complaint against county agents and other agricultural extension service employes. Every statement and charge is supported by a mass of evidence. Briefly the statement sets out:

1. That the veterinary profession has rendered, is now rendering and is qualified to render in the future, a service absolutely essential to agriculture.

2. That the Agricultural Extension Service of the U. S. Department of Agriculture cannot render this service to agriculture.

3. That county agents, paid from Federal and State funds, make it a practice to buy and sell veterinary biologics, drugs and instruments, and to a less extent, fertilizer, spray materials, lumber, coal, gasoline, oil and many other articles.

4. That county agents engage in the practice of veterinary medicine and although laymen, attempt to diagnose and to treat the following diseases of farm animals:

a. CATTLE.—Parturient paresis, mastitis (garget), hemorrhagic septicemia, Bang's disease, blackleg, anthrax.

b. HOGS.—Hog cholera, swine plague, swine erysipelas, necrotic enteritis, internal and external parasitic infestations and nutritional diseases.

c. SHEEP.—Hemorrhagic septicemia, nutritional diseases and internal parasitic infestations.

d. POULTRY.—Fowl cholera, fowl typhoid, fowl pox, internal and external parasitic infestations.

County agents also attempt the diagnosis and control of avian tuberculosis and undertake the vaccination of dogs for the prevention of rabies and distemper.

5. That the activities of county agents listed in the foregoing are not authorized by the provisions of the Smith-Lever Act and are in direct violation of the regulations promulgated by the Secretary of the United States Department of Agriculture prescribing the duties of extension service employes and of the laws in 46 states governing veterinary practice.

6. That as a result of the activities of Federal and State Agricultural extension services in the field of veterinary practice many veterinarians have abandoned their practices and have sought employment in the Bureau of Animal Industry, U. S. Department of Agriculture or in the state veterinary forces. Others have been forced to seek employment in other fields of endeavor to provide a living for their families.

7. That continued activity of the Federal and State Agricultural Extension Services in the field of veterinary practice will result in depriving agriculture of a veterinary service which is indispensable to its existence on the present scale and on the plan now followed in this country.

The issue between the veterinary profession, the Agricultural Extension Services of the U. S. Department of Agriculture and the agricultural extension services of numerous states is joined. The veterinary

profession has stated its position officially. The outcome is not readily predictable. The extension services are strongly intrenched and have developed into a powerful political machine. Favoring the veterinarians' cause is the popular revulsion toward unnecessary governmental activities and the waste of public funds they occasion. In any case the atmosphere has been cleared of pretentions; any middle ground is untenable. Each veterinarian must take his stand with the profession or against it.

The veterinary profession officially and as individuals has expressed, repeatedly, its sympathy with the objects of the Smith-Lever Act, although perhaps questioning the propriety of that law on the ground that the education of their citizens is, under our system of government, a responsibility of the states, and not of the Federal government. Repeatedly, representatives of the profession have endeavored to persuade the Agricultural Extension Services of the U. S. Department of Agriculture and of various states, to abide by the provisions of the act of Congress responsible for its creation. The committee has had forced upon it the conviction that these services cannot be expected to abide by those provisions; that the activities of the extension services are harmful to the veterinary profession and agriculture, and that there is not the slightest basis for the expectation that these services will at any time in the future either abide by the provisions of the Smith-Lever Act and the regulations of the Secretary of Agriculture, or that they will render a beneficial service to agriculture that will to any material degree, compensate for the harm they have done, are now doing and will inevitably continue to do unless they are abolished.

It is submitted that the Agricultural Extension Services of the U. S. Department of Agriculture and of numerous states is the most perfect example of bureaucracy at its worst that is afforded by American government; that the $25,000,000 that these services cost the tax payers annually is far worse than wasted, and that it represents one of the most deplorable examples of government in business.

The utter contempt that the agricultural extension services, both of the Federal government and of some of the states, has shown for the provisions of the Smith-Lever Act, the regulations promulgated by the Secretary of Agriculture, the veterinary practice acts of the states concerned, the ordinances governing merchandising in the cities concerned, and the laws and regulations governing the use of the United States mails, and the habitual flagrant violations of all of these laws and regulations by these services, is and always has been so notorious that it is absolutely futile to ask of Congress or of state legislatures further laws to abate these nuisances. To provide more laws on the subject will simply afford the agricultural extension services more laws to flout. The only solution of the problem lies in the abolishment of these services.

It is the conviction of the A. V. M. A. Committee that the interference with veterinary practice on the part of the agricultural extension services, bad as it is and extensive as it has been, has only begun in comparison with what it is the settled intention of these services to accomplish. Unquestionably a drive is on to exempt county agents from the provisions of the veterinary practice act in each state in the union. This drive has already succeeded in North Carolina and Nebraska, and is well under way in Illinois. Had the result of the election in this state on November 8th been different from what it was, this purpose would undoubtedly have been accomplished in Illinois during the coming winter. Why these services should seek the countenance of laws they have violated with impunity is not known. It is not thought to be due to a moral awakening.

It is the undoubted belief of the committee that it is the settled policy of the Agricultural Extension Services of the U. S. Department of Agriculture and of numerous states to "Sovietize" veterinary medicine in the interest of more and bigger jobs for bureaucrats.

The A. V. M. A. Committee on Agricultural Extension Service will welcome additional reports of specific instances of county agents or vocational agricultural teachers engaging in veterinary practice.

Examination of Feces for Parasite Eggs

THE day has long since passed if it ever existed when it sufficed to poke about with a stick in the feces of an animal, or just look at the animal and guess that it did or did not have worms. Great progress has been made in the science of parasitology, and more refined, more exact and far more productive methods of examination for the detection of parasite infestation must be employed by any veterinarian who makes even a pretense of keeping up to date in his profession and rendering his clientele a scientific, worth while service.

An examination of feces for the detection of the eggs of intestinal parasites is so important and so frequently called for that it must be regarded as a routine measure in small animal practice; like recording the name and address of the owner or tagging the leash and collar. In other practice, the need for it is only a little less universal.

A microscope of course, is essential for such an examination. If there is any veterinarian who still thinks that he can render a good enough service in his practice without the microscopic examination of feces, it may be mentioned that this instrument is equally essential or nearly so in the diagnosis of skin diseases, and for other purposes, and furthermore, that the price of a microscope is not to be considered an expense, but an investment that will yield as great a return in additional fees as any investment for his practice that a veterinarian can make, to say nothing of the satisfaction it brings.

While on the subject of the microscope, it should be said that a laboratory instrument is the one to procure. While low-power magnification may suffice for the examination of feces and skin scrapings, the cheap instruments, because of limited field, inconvenience of handling, inadequate stage, difficulty of adjustment, poor definition of objects as small as parasite eggs (distinguishing characteristics cannot be seen), etc., are but makeshifts in the hands of the inexperienced; and are generally unsatisfactory. For the busy practitioner they are but interesting scientific toys and not likely to be used much longer than the average toy.

There are two general methods of examining feces to determine the presence or absence of parasite eggs, and if eggs are present, the identification of the parasites with which the animal is infested. They are known as the smear method and the gravity method. The latter is often termed the "sugar method," although various solutions of high specific gravity, other than sugar solutions may be used.

Both methods have their champions who stoutly maintain the superiority of the method of their choice. There are certain advantages and disadvantages of each, however, that are not subject to question. The smear method requires the lesser equipment and the gravity method is the more exact. As to which is the quicker, there is no unanimity of opinion.

Smear Method

In addition to a microscope, which is required in both methods, the smear method requires only a glass slide in the way of equipment. A thin smear of feces is made over the center of the slide and to this is added a drop or two of water or an equal amount of a 10% solution of caustic soda or caustic potash.

The smear is then examined under the low-power (10X ocular and 16mm or 2/3 objective). No cover glass is required.

Advantages claimed for the method are that little equipment is required. The examination can be made quickly and that if the animal is parasitized to a harmful extent, the eggs will be numerous enough in the feces to reveal them even in this very small portion of the total amount of feces. If eggs are not detected in the first smear, usually two

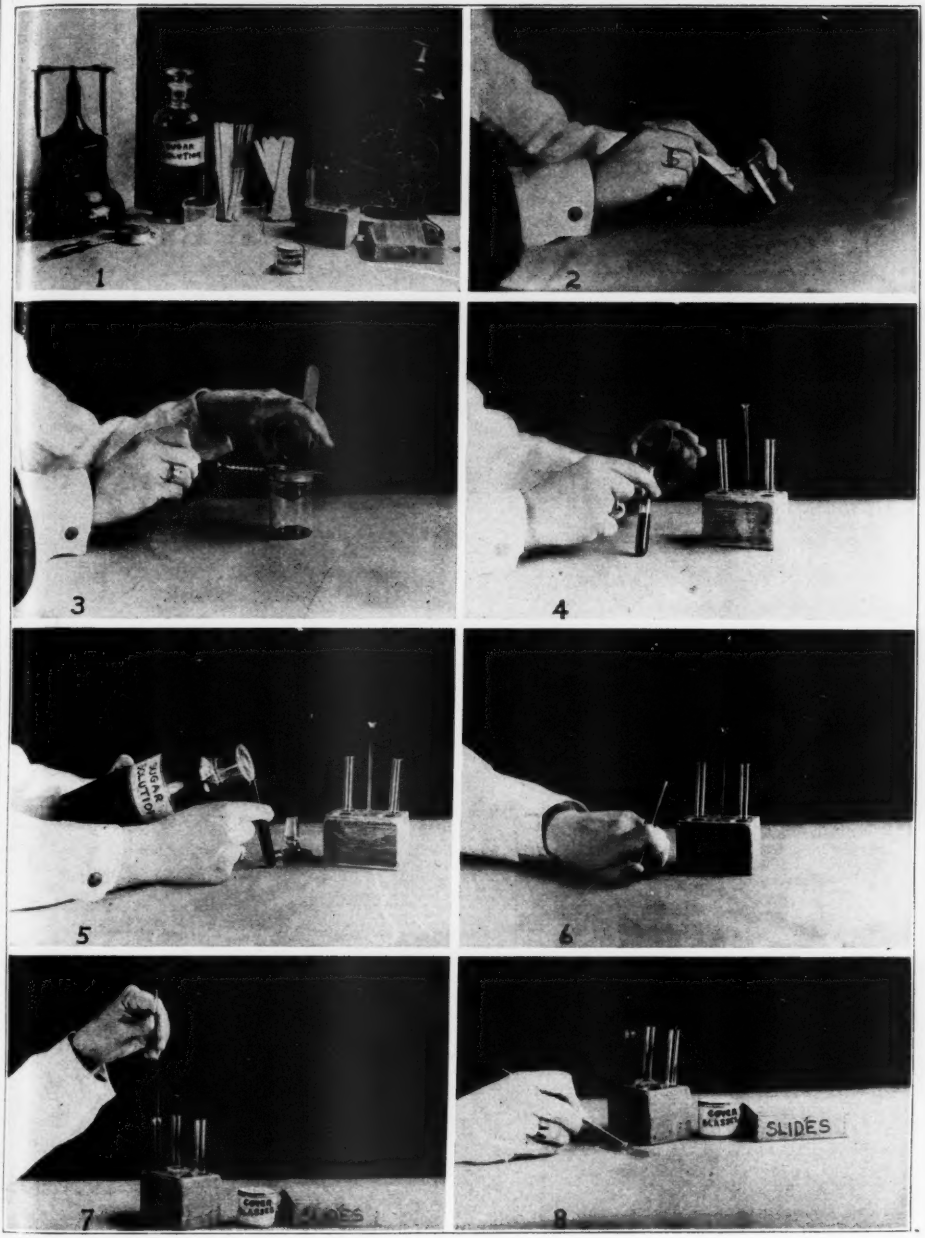


Fig. 1. Apparatus and materials used in making fecal examinations for parasite eggs.—Benbrook.

Fig. 2. Mixing feces with enough water to liquefy it.—Benbrook.

Fig. 3. Removal of coarse particles from feces by straining.—Benbrook.

Fig. 4. Filling a tube nearly half full of the fecal suspension.—Benbrook.

Fig. 5. Adding sugar solution equal in amount to the fecal suspension.—Benbrook.

Fig. 6. Mixing sugar solution and feces by inverting the tube several times.—Benbrook.

Fig. 7. Lifting off the surface layer of liquid from the tube after centrifuging, using a "headed" glass rod.—Benbrook.

Fig. 8. Transferring a drop from the tube to a microscope slide.—Benbrook.

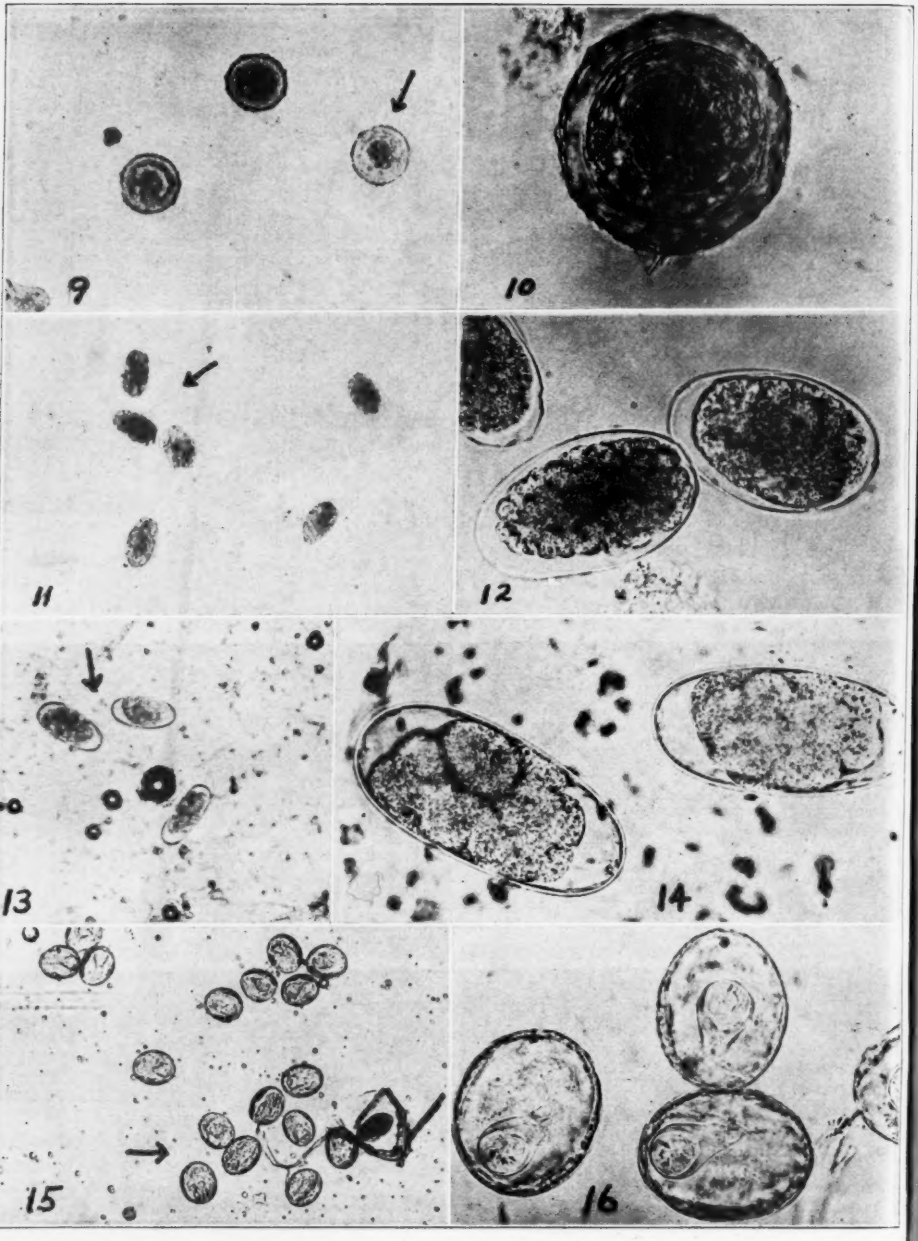


Fig. 9. Egg of Ascaris equorum, the common round worm of the horse. x 100. Color of egg, light yellow.—Benbrook.

Fig. 10. Same as Fig. 9. x 400.—Benbrook.

Fig. 11. Eggs of Strongylus vulgaris of the horse. x 100. The numerous species of the Strongylidae family of the horse have not been differentiated by the appearance of the eggs. See also Fig. 13.—Benbrook.

Fig. 12. Same as Fig. 11. x 400.—Benbrook.

Fig. 13. Strongylidae eggs from the horse. x 100.—Benbrook.

Fig. 14. Same as Fig. 13. x 400. Figs. 11, 12, 13 and 14 will serve to identify the group.—Benbrook.

Fig. 15. Eggs of Anoplocephala mamillana, a tapeworm of the horse. x 100. The other tapeworms of the horse produce similar eggs.—Benbrook.

Fig. 16. Same as Fig. 15. Note the pear-shaped covering around the embryo. x 400.—Benbrook.

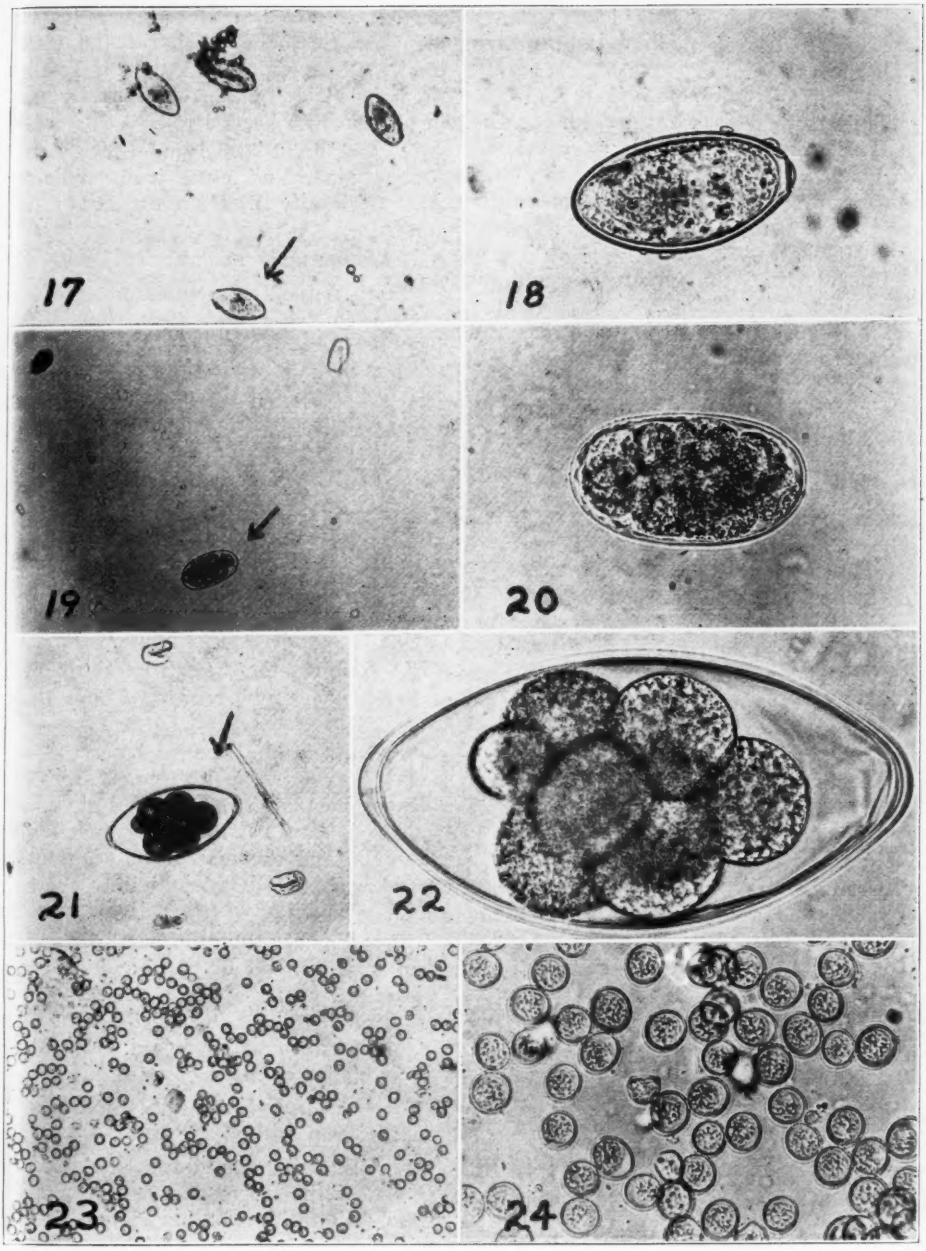


Fig. 17. Egg of Oxyuris equorum, the pinworm or rectal worm of the Horse. x 100. Note the operculum or cap at one end of the shell.—Benbrook.

Fig. 18. Same as Fig. 17. x 400.—Benbrook.

Fig. 19. Egg of Hemonchus contortus, stomach worm of Sheep, Cattle and Goats. x 100.—Benbrook.

Fig. 20. Same as Fig. 19. x 400.—Benbrook.

Fig. 21. Egg of Nematodirus filicollis, one of the hair-like nematodes of the small intestines of sheep, cattle and goats. x 100.—Benbrook.

Fig. 22. Same as Fig. 21. x 400.—Benbrook.

Fig. 23. Oocysts of Eimeria zurni, coccidium of Cattle. x 100. —Biester.

Fig. 24. Same as Fig. 23. x 400.—Biester.

or three or even a half dozen smears are made before making a negative diagnosis.

Gravity Method

This method was originated by Dr. A. Leslie Sheather, a veterinary pathologist of London, England. He is remembered by American veterinarians as one of the translators of the first American edition of Hutyra and Marek.

Considerable equipment is required, but other than the microscope, the cost of it is very little. Benbrook[1] lists the equipment required as follows:

Microscope of the usual medical type giving low power and high power magnification of approximately 100 and 400 diameters.

Centrifuge: Hand, water, steam or electric types may be used, the latter being preferable.

Microscope slides 1 x 3 inches.

Micro cover-slips, ¾ inch squares.

Several beakers of 100cc capacity; or, inch, or centrifuge tubes of 15cc capacity.

Several breakers of 100cc capacity; or, ordinary drinking glasses.

Wire gauze tea strainer of approximately 30 mesh per inch.

Several 6-inch lengths of 5mm glass rod.

Wooden tongue blades.

Fine pointed forceps, 5-inch.

Granulated sugar.

The same author gives the following directions for the preparation of the sugar solution, and for making the fecal examination:

Sugar solution should be made as follows:

Granulated sugar, 1 pound.

Water, 12 ounces.

Dissolve the sugar in the water, by immersing the bottle in hot water.

Add 1% phenol as a preservative.

To make a "headed" glass rod heat one end of a six inch length of 5mm glass rod until it is soft enough to be "headed" against a cold metal object. The head portion should be just slightly less in diameter than the inside of the tubes used. A heavy glass rod, slightly smaller than the inside of the tube may be used in place of the headed rod.

1. Pick up at least 1gm. of feces using tongue blade and place it in sufficient water to liquify it. Do not use too much water.

2. Thoroughly mix the feces with the water.

3. Coarse particles may be removed if necessary by straining.

4. Fill a test tube or centrifuge tube nearly half full of the fecal mixture.

5. Add to the above an equal quantity of sugar solution.

6. Mix by slowly inverting the tube several times.

7. Centrifuge the tube containing the mixture for about three minutes at moderate speed, 1,500 to 2,000 r.p.m. Centrifuging may be omitted if the tube is allowed to stand 12 to 24 hours.

8. Remove the tube from the centrifuge to a test tube holder without shaking.

9. Lift off the surface layer of fluid (which now contains the eggs) from the tube by means of the prepared glass rod. The rod should be slowly lowered into the tube and the instant full contact is made with the liquid withdraw the rod quickly bringing with it a large drop.

10. Transfer the drop from the rod to a microscope slide by gently rotating the rod in the center of the slide. A second or third drop may be added to the first in order to obtain sufficient material to fill in under a micro cover-slip.

11. Carefully lower a micro cover-slip on the drop without pressure.

12. Examine the slide under the low power of the microscope. For best results, bright illumination should be obtained by adjusting the mirrow and condenser and then modified by closing the diaphragm opening. The specimen should be searched in a systematic manner in order to see all parts of the drop

[1] Benbrook, E. A.; Fecal Examination for Evidence of Parasitism in Domestic Animals; Division of Veterinary Medicine, Iowa State College, Veterinary Practitioners' Bulletin, Vol. IX, No. 1, April, 1929.

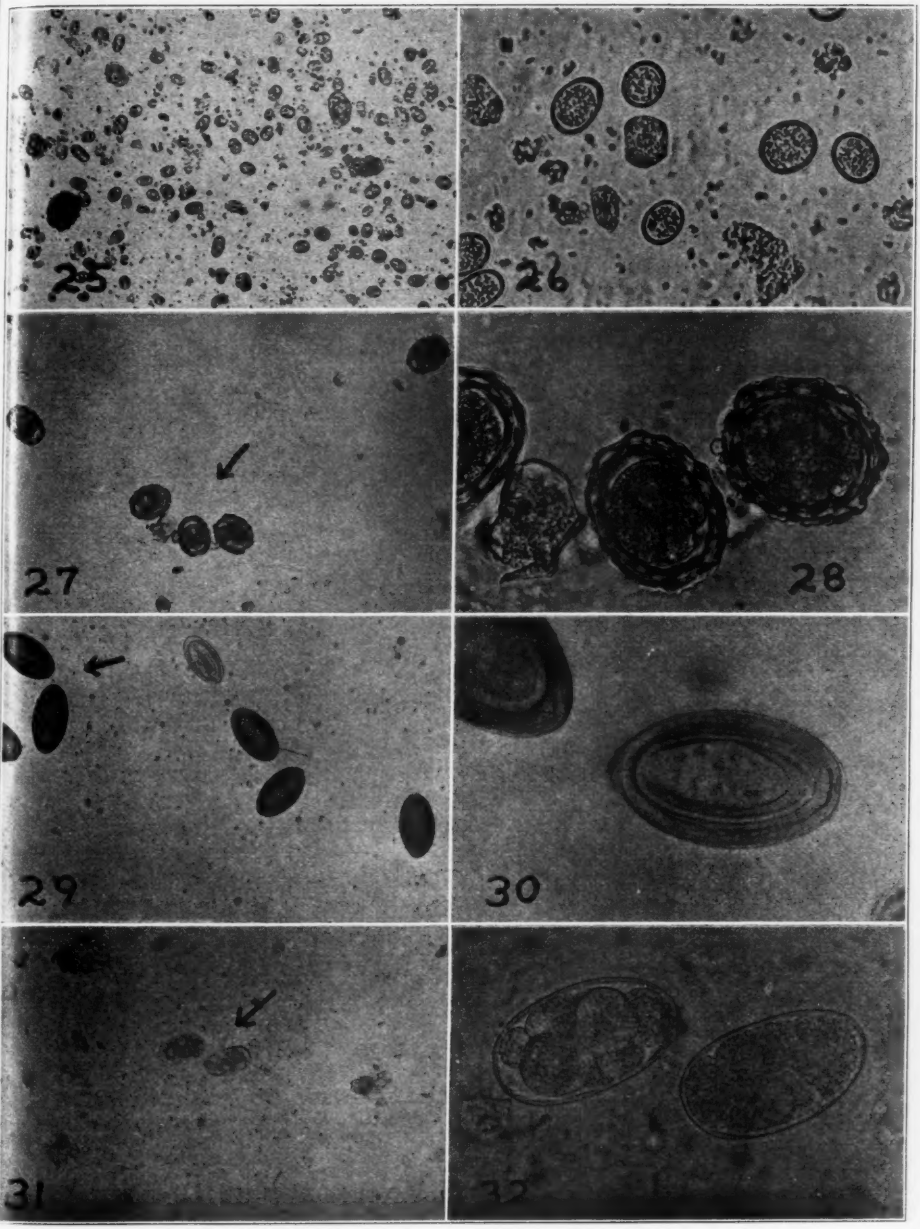


Fig. 25. Oocysts of Eimeria debliecki, coccidium of swine. x 100.—Biester.

Fig. 26. Same as Fig. 25. x 400.—Biester.

Fig. 27. Eggs of Ascaris lumbricoides (or suum), the common round worm of swine. x 100. The eggs are yellow.—Benbrook.

Fig. 28. Same as Fig. 27. x 400.—Benbrook.

Fig. 29. Eggs of Macrocanthorhynchus hirudinaceus, the thorn-headed worm of swine. x 100. The eggs are brown.—Benbrook.

Fig. 30. Same as Fig. 29. x 400.—Benbrook.

Fig. 31. Eggs of Esophagostomum dentatum, nodule worm of swine. x 100.—Benbrook.

Fig. 32. Same as Fig. 31. x 400.—Benbrook.

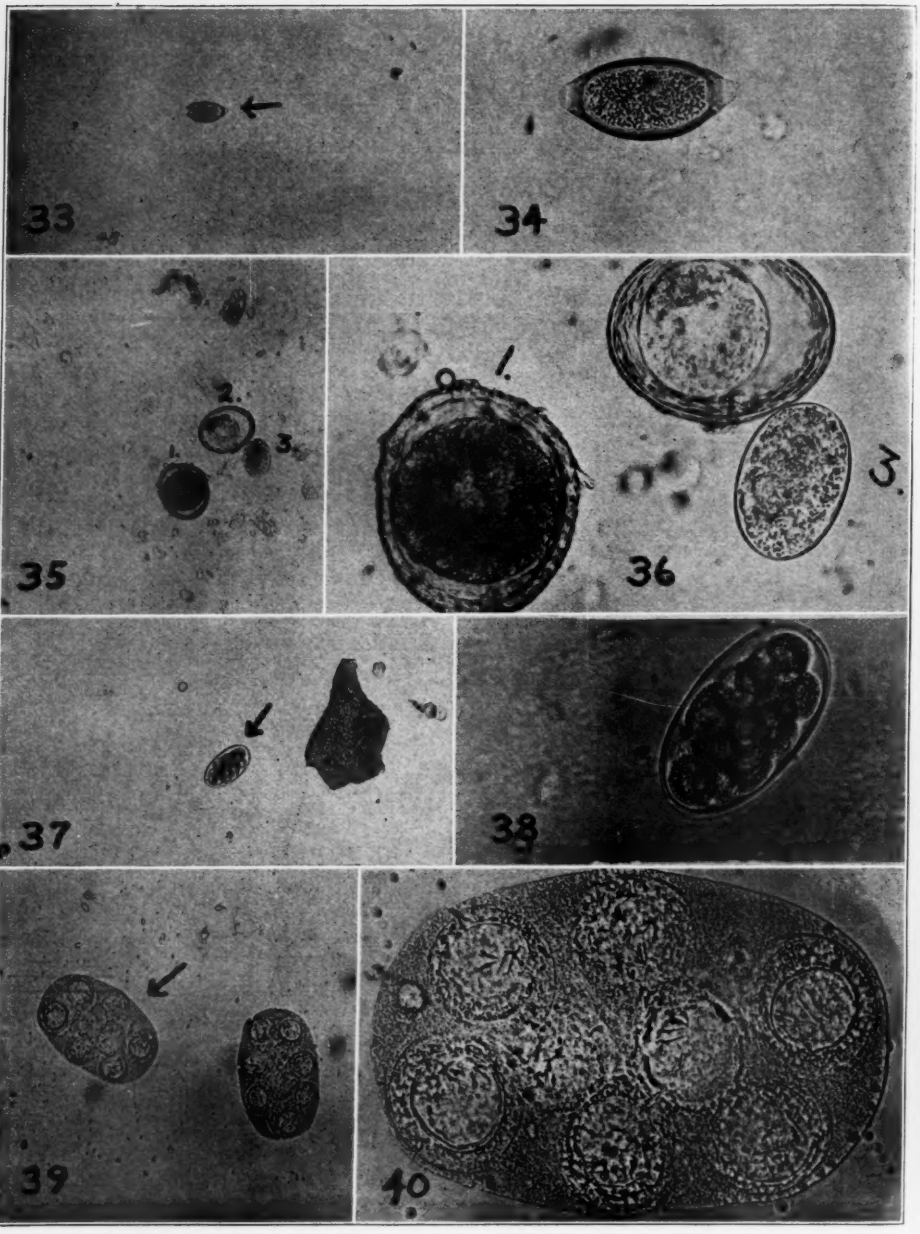


Fig. 33. Egg of Trichuris suis, whipworm of swine. x 100. Yellow brown color.—Benbrook.

Fig. 35. Eggs from the feces of a dog. No. 1. Belascaris marginata. No. 2. Toxascaris limbata. No. 3. Uncinaria stenocephala. No. 1 is yellow. Nos. 2 and 3 are colorless. x 100.—Benbrook.

Fig. 37. Egg of Ancylostoma caninum, a hookworm of the dog. x 100.—Benbrook.

Fig. 39. Eggs of Dipylidium caninum, one of the tapeworms of the dog and cat. The eggs are contained in the capsule. x 100.—Benbrook.

Fig. 34. Same as Fig. 33. x 400. Note the lemon-shaped outline.—Benbrook.

Fig. 36. Same as Fig. 35. x 400.—Benbrook.

Fig. 38. Same as Fig. 37. x 400.—Benbrook.

Fig. 40. Same as Fig. 39. Note the hooklets in each embryo. All tapeworm eggs have hooklets. x 400.—Benbrook.

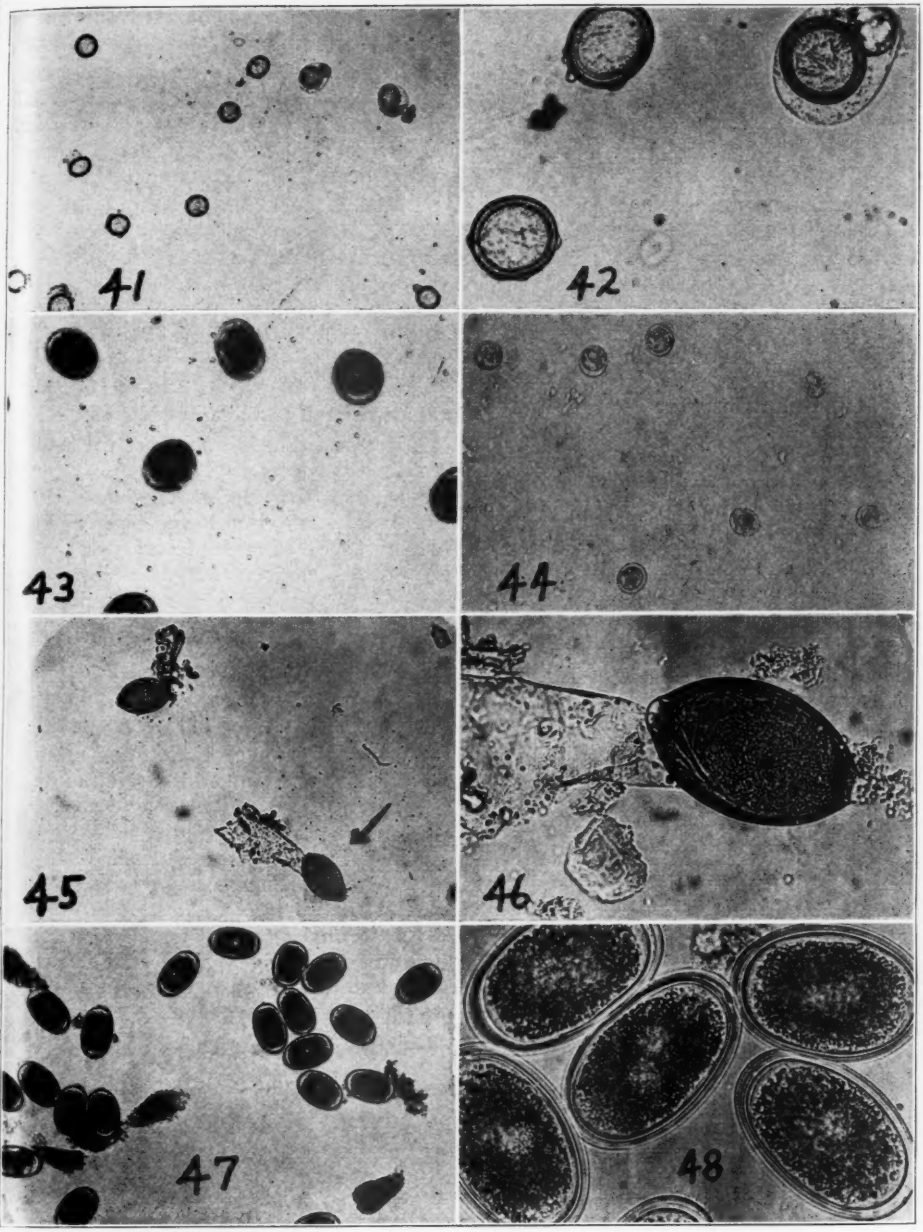


Fig.41. Eggs of Taenia pisiformis, one of the tapeworms of the dog. x 100. Color yellow.—Benbrook.

Fig. 42. Same as Fig. 41. x 400.—Benbrook.

Fig. 43. Oocysts of coccidia in the feces of the dog. x 100. The coccidia are the small bodies. The larger bodies are roundworm eggs slightly out of focus.—Benbrook.

Fig. 44. Same as Fig. 43. x 400.—Benbrook.

Fig. 45. Eggs of Trichuris depressiuscula, the whipworm of the dog. x 100. Color yellowish brown.—Benbrook.

Fig. 46. Same as Fig. 45. x 400.—Benbrook.

Fig. 47. Eggs of Ascaridia lineata the roundworm of chickens. x 100.—Benbrook.

Fig. 48. Same as Fig. 47. x 400.—Benbrook.

and yet not go over the same part more than once.

13. When parasite eggs are seen, the high dry power should be used for identification in comparison with the photomicrographs.

It would be well to mention that the fecal examination method described may not be absolutely perfect in its results for various reasons:

1. No eggs may be found because the parasites present are not mature enough to produce eggs.

2. Animals having diarrhea may pass parasite eggs so diluted by liquid feces as to make detection difficult.

3. Tapeworm eggs may be passed within the segments of the worm. Thus examination for tapeworms may be negative, or unnecessary when segments are observed in the feces.

4. Oily substances such as castor oil in the feces may interfere with the findings of eggs, by floating on the top of the tube contents. Various methods have been attempted in order to remove such oil from feces but so far without success.

5. It may be confusing to find foreign eggs present. For instance, dogs may show ova of horse, pig or chicken parasites in the feces. This is no doubt the result of coprophagia.

6. Cleanliness of all utensils used is imperative, in order to prevent carrying eggs from one examination to the next. All tubes, rods, sieves and beakers should be thoroughly washed and brushed out as soon after using as possible. Wooden tongue blades should be used only once.

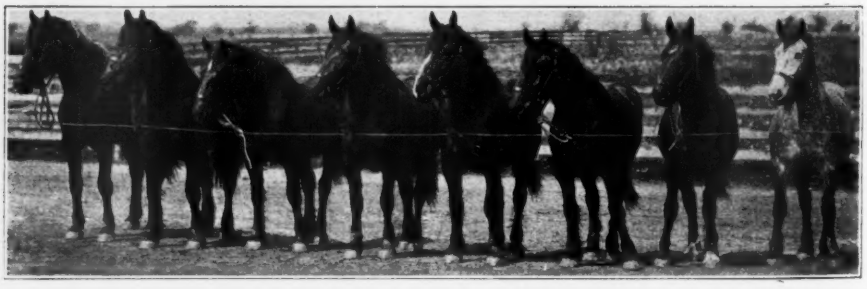
Other technicians give directions differing but little from the foregoing except as to the amount of feces used. Many regard one or two ounces of feces or even more as being more likely to give accurate results than a smaller quantity.

Although such directions may at first reading lead one to think that the examination is involved, it can be performed readily in five to ten minutes. In fact, those who use it say that the examination can be made quicker in this way than by the smear method since the field, being free of feces, the eggs can be more readily recognized and more easily identified.

The outstanding advantage of the method lies in its undoubted greater accuracy than can be attained by the smear method. There are those, however, that regard even this a disadvantage, since by concentrating the eggs from a large quantity of feces, it may lead the practitioner to regard the parasitic infestation as far heavier than it really is.

Flotation Method

A modification of the gravity method in which centrifuging the specimen is not necessary is termed the flotation method. In this the specimen for examination is prepared as for centrifuging but is put in a shell vial which is filled with the saturated sugar solution level with the brim. A microscope slide is then laid across the mouth of the vial in contact with the surface of the liquid. After five minutes the slide is removed. Parasite eggs that have risen to the surface adhere to the slide and are examined in the usual way.



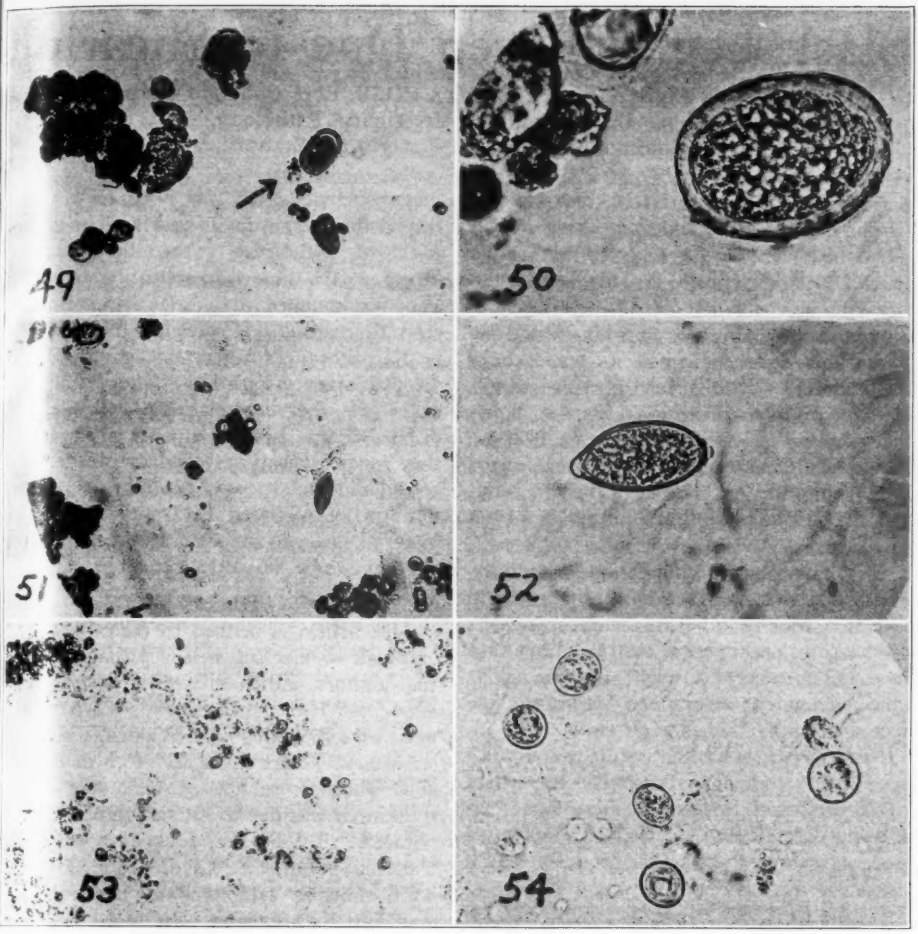


Fig. 49. Eggs of Heterakis gallinae, the cecal worm of chickens. x 100.—Benbrook.
Fig. 51. Egg of Capillaria retusa, a hair-like nematode of the small intestine of chickens. x 100. Note the two lemon-shaped eggs.—Benbrook.
Fig. 53. Oocysts of Eimeria tenella, coccidium of chickens. 100.—Benbrook.

Fig. 50. Same as Fig. 49. x 400.—Benbrook.
Fig. 52. Same as Fig. 51. x 400.—Benbrook.
Fig. 54. Same as Fig. 53. x 400.—Benbrook.

The photomicrographs accompanying this article were taken by E. A. Benbrook of the Department of Veterinary Pathology, Iowa State College, Ames, assisted by Margaret W. Sloss.

The camera used is a Leitz Photomicrographic Apparatus Type VMA with apochromatic microscope objectives. Eastman Wratten M plates and a Wratten A color filter were used. Exposures varied from a few seconds to about two minutes, using a six-volt coil filament light source.

The arrows in the 100-magnification illustration indicate the field that is enlarged to 400 magnifications in the illustration on the right to show more detail in the eggs and facilitate their identification. The parasite eggs and debris shown in these illustrations are just as they appear when viewed through the low power 10× (16mm) objective and through the high power 40× (4mm) dry objective with the usual 10× ocular of a standard microscope, no reduction or enlargement having been made in their reproduction in this article.

Black Leg in Sheep Due to Shearing

By I. E. NEWSOM and FLOYD CROSS, Fort Collins, Colorado
From the Section on Veterinary Pathology,
Colorado Agricultural Experiment Station

AS Marsh[1] has reviewed recently the question of blackleg in sheep it will be unnecessary to do so in this article. It will be sufficient to say that while the Germans have for many years described the disease in these animals, only Marsh and his co-workers have confirmed its presence in this country. That author described blackleg as a result of bruising incident to fighting in rams[2] as early as 1919. In 1928 he tabulated 16 outbreaks which were diagnosed clinically as blackleg with the isolation of *Cl. chauvei* in pure culture from ten of them.

Marsh felt, along with European authors, that blackleg in sheep was generally a wound infection usually following such operations as shearing, docking and castrating but that in some instances it might develop spontaneously when sheep were on heavily infected ground.

Recently the association with wounds has received further confirmation at the hands of Roberts and McEwen[3] in England. As a result of their investigation of 68 cases of gas gangrene in sheep on the Romney Marsh they concluded that *Cl. chauvei* was the responsible organism in nearly all of them. Most of their cases were the result of injury at the time of parturition but they also incriminated the same organism in castration and docking wounds in lambs and in four instances where gas gangrene developed after vaccination. They report no cases of shearing blackleg. While *Cl. oedematis* was isolated on several occasions they regarded it as a secondary invader and considered that it could not be incriminated until it was isolated from perfectly fresh material. In one instance they believed the gangrene to be caused by *Cl. novyi*.

Sheep artificially infected with blackleg. Note the swelling on the back of the thigh and the cocked ankle. No weight is borne on the affected leg.

History

This article is penned to record the first outbreak of blackleg in sheep diagnosed by the authors either clinically or bacteriologically. Hand shearing was started on a band of 2,000 ewes near Walden, Colorado, on Monday, May 9, 1932. Two days later some sheep were noticed lame, the owner thinking it was due to rough handling by the shearers. By Friday, four days after the shearing began, 30 had died and 20 more were showing symptoms of lameness. It was on that evening and the following morning that our observations were made. All but 52 of the animals had been shorn.

Symptoms

The sick ewes would get lame, usually in a hind leg, stop feeding and fall behind the band. The affected limb was carried without bearing weight on it and when the foot touched the ground the claws often extended backward so that the front of the fetlock rested on the ground. The limb was swollen, was of a blue-black color and pitted on pressure. Crepitation could not be determined.

Lesions

In practically all cases there were one or more shear wounds near the hock. Under

the discolored skin was a collection of non-gaseous edema frequently bloodstained. On cutting through the leg and thigh muscles they were found black, gaseous, dry and spongy. Not all muscles were equally affected, thus leaving a marked contrast with the unaffected tissue. The edema sometimes extended as far down as the claw and as far up as the spine.

Six animals were posted, two of which were slaughtered for the purpose. Those already dead and one of the killed ones showed the lesions as described above. The other showed much subcutaneous edema but no blackening of any muscle tissue. Material was taken from these six animals for laboratory examination.

Use of Serum

At this time a clinical diagnosis of blackleg having been made, about 20 of the sick animals were given, subcutaneously, 10cc each of anti-blackleg serum. Those selected were not those already moribund but those showing lameness and yet considerable strength. In fact, many given serum were so lively that some difficulty was experienced in catching them. Later the owner reported that all given serum died. In fact, all that ever showed symptoms died.

McEwen and Roberts[4] have shown that not much can be expected from serum after symptoms of the disease have become evident except when large doses are given and these given intravenously. In their work some favorable results were experienced with doses of 100 cubic centimeters.

Bacteriological Examination

From five of the animals, smears from the edematous fluid and from the blackened muscle showed both vegetative and spore forms. From one of the animals slaughtered (No. 4) only vegetative rods were seen in the subcutaneous edema but no organism could be demonstrated in the muscle which in this animal was not blackened.

Direct cultures were made by placing small pieces of muscle in freshly boiled brain medium and guinea pigs were inoculated into the thigh with emulsions made from the same type of tissue. By means of direct cultures *Cl. chauvei* was isolated in pure culture from all but one (No. 3). From the guinea pigs inoculated with muscle suspension, pure cultures of the same organism were obtained from the four sheep that died, pigs numbers four and six surviving. It will be recalled that sheep number four was one of the slaughtered animals the muscle of which was not black and smears from which showed no organisms. Either by direct culture or by guinea pig inoculation *Cl. chauvei* was obtained from every sheep posted and in the case of three of them by both methods. In some instances aerobic cocci were obtained but were easily eliminated by heating. In only one case was any other spore bearing anaerobe found, that being a putrefactive organism, probably *Cl. sporogenes*. It was eliminated by guinea pig inoculation.

The criteria for determining *Cl. chauvei* were non-putrefactive spore bearing anaerobe, gram positive, pathogenic for guinea pigs, not producing filaments on the liver of those animals, no blackening in either plain brain or iron brain media, litmus milk, acid but no gas, liquefying gelatin, fermenting lactose and sucrose but not salicin.

Further Clinical Data

May seventeenth, four days after our visit to the flock, the owner brought a pregnant ewe to the laboratory with the statement that 124 had died but that he thought a new disease might have made its appearance since a few of the animals were showing a considerably enlarged abdomen and no lameness. The animal brought in was of this type and on unloading it there was some straining accompanied by the discharge of sanious fluid from the vulva. The abdomen did appear enlarged but was not gaseous and there was no lameness. She died during the night without aborting.

Postmortem examination revealed no wounds nor subcutaneous edema. A considerable amount of straw colored fluid containing several large white clots was present in the peritoneal cavity. There was a nearly full time fetus in the uterus. Over one side of the uterus between the uterine wall and the chorion was a very noticeable accumulation of straw colored, gelatinous

fluid approximating six by nine inches in extent and from one to one and a half inches in thickness.

Smears made of this fluid revealed no bacteria. Cultures in brain media gave *Cl. chauvei* in pure culture. Culture from the spleen of this ewe gave the same organism.

By the twenty-third, ten days after our visit, the owner reported that there had been no loss for three days and that the disease had apparently run out. One hundred and twenty-five had died showing lameness and about twenty more that showed only the enlarged abdomen. None of these aborted.

On our first visit, although only 52 animals remained to be shorn we advised boiling the shears for 20 minutes, a thorough clean-up of the shearers and that these sheep be shorn in a different barn. In spite of these precautions which were faithfully carried out the owner believed that two of those shorn last, died of blackleg.

It may be of interest to say that the men who were professional shearers had no losses in the flock shorn just previous to this one nor in the one to which they went next. They did, however, again boil their shears and clean up themselves before going to the next place.

Sheep artificially infected with blackleg. Note the enlargement of the right leg and the edematous fold of skin between the legs.

The question arises whether the infection came from or was transmitted by the shears or whether it was in the wool or in the soil on which the sheep lay after being shorn. There is no definite information. It is known, however, that blackleg had previously affected cattle on the place. Taking into consideration the facts as set forth it would seem that the fresh wounds were contaminated from the soil. This does not, however, explain the manner of infection of those 20 that showed only accumulations of fluid in the abdominal cavity.

Immunization

First Experiment.—Having determined that 2cc of a bouillon culture of the isolated organism was fatal to a sheep in less than 24 hours the following test was set up to determine the value of aggressin and bacterin when used on sheep. Both of these agents were purchased on the open market and were made by one of our leading manufacturers, presumably from a cattle organism. It seems also safe to assume that the aggressin was made from the muscle juice of a calf. Two mature sheep were given respectively 5cc and 2½cc of aggressin and two others the same amounts of bacterin. After 21 days each of the above and one control were given 2cc of a 24-hour bouillon culture of the organism. All sheep died except the one receiving 2½cc of the bacterin.

Determination of Lethal Dose

Since it appeared from the above experiment that the dosage was too large for the purpose, four unimmunized sheep were now selected and given 1cc, 0.5cc, 0.25cc and 0.1cc respectively. All died except the one receiving 0.1cc.

Second Experiment.—The first experiment was now repeated with two sheep receiving 2½cc amounts of the immunizing products instead of one and using 1cc of the virulent culture in place of 2cc as in the

TABLE I
Experiment I.—To determine the immunizing value of aggressin and bacterin

Sheep No.	Product	Amount	Date of Injection	Amount Culture	Culture Injected	Hours Till Death
1	Aggressin	5cc	6–8–32	2cc	6–29–32	26
2	Aggressin	2.5cc	6–8–32	2cc	6–29–32	24
3	Bacterin	5cc	6–8–32	2cc	6–29–32	39½
4	Bacterin	2.5cc	6–8–32	2cc	6–29–32	Lived
5	Control			2cc	6–29–32	19½

TABLE II
Determination of lethal dose of organism

Sheep No.	Amount Culture	Hours Till Death	Remarks
1	1cc	47	Died during night
2	.5cc	34	Accurate observation
3	.25cc	47	Died during night
4	.1cc	Lived	

previous experiment. The results were very striking. All of the aggressin sheep died and all of the bacterin sheep lived.

Third Experiment.—It appears from the previous experiment that bacterin was to be preferred to aggressin for immunizing sheep, the question arose whether 1cc of bacterin might not be sufficient for field immunization. Accordingly, six lambs and one ewe were given 1cc of the commercial bacterin used in the previous experiment. Twenty-six days later all of these and a control unimmunized lamb were given 1cc of a bouillon culture of *Cl. chauvei* as in the previous work. One the next day, it having become apparent that the control would survive, another control was inoculated with the same amount of culture. This latter lamb died in 31 hours.

Two of the six immunized lambs died. The ewe remained well. The survival of the first control showed that some sheep are naturally immune to blackleg. This phenomenon has already been observed in cattle by those who have attempted to test out the various biological products for blackleg. Scott[5] has estimated that as high as 20% of calves may be naturally immune.

Fourth Experiment.—Since the bacterin used had shown such superiority over the aggressin, both having been made by the same house, it was decided to test these products made by another concern. Old sheep were used for this experiment and aggressin and bacterin, the product of another manufacturer, were purchased on the

TABLE III
Experiment II.—To determine the immunizing value of aggressin and bacterin

Sheep No.	Product	Amount	Date of Injection	Amount Culture	Culture Injected	Hours Till Death
1	Aggressin	5cc	7–11–32	1cc	8–2–32	32½
2	Aggressin	2.5cc	7–11–32	1cc	8–2–32	32½
3	Aggressin	2.5cc	7–11–32	1cc	8–2–32	24
4	Bacterin	5cc	7–11–32	1cc	8–2–32	Lived
5	Bacterin	2.5cc	7–11–32	1cc	8–2–32	Lived
6	Bacterin	2.5cc	7–11–32	1cc	8–2–32	Lived
7	Control			1cc	8–2–32	28

TABLE IV
Experiment III.—To determine whether 1cc of bacterin was an effective immunizing dose

Lamb No.	Bacterin	Date of Injection	Amount Culture	Culture Injected	Hours Till Death
1	1cc	8–18–32	1cc	9–13–32	67
2	1cc	8–18–32	1cc	9–13–32	43
3	1cc	8–18–32	1cc	9–13–32	Lived
4	1cc	8–18–32	1cc	9–13–32	Lived
5	1cc	8–18–32	1cc	9–13–32	Lived
6	1cc	8–18–32	1cc	9–13–32	Lived
Ewe	1cc	8–18–32	1cc	9–13–32	Lived
Control I			1cc	9–13–32	Lived
Control II			1cc	9–14–32	31

open market. Two sheep were given 5cc of aggressin, two 5cc of bacterin, two 2½cc bacterin and two 1cc bacterin. Because it had previously been shown that blackleg cultures lose their virulence, the lethal dose of the culture was again determined. This time the sheep given 2cc and 1cc died and the one given 0.5cc survived. Consequently the test dose of culture was now 2cc instead of 1cc as formerly. This was administered to all sheep 26 days after immunization. One that had received 1cc of bacterin and one that had been given 2½cc bacterin died. The others survived.

Discussion of the Immunization Experiments

Whether any conclusions should be drawn from the work with bacterins and aggressins is a grave question. It seemed from the work with the first products that bacterin was superior to aggressin but this was not borne out with the preparations of the second manufacturer. If, however, bacterins are as reliable as aggressins they are to be preferred since they do not require the destruction of calves for their manufacture and should consequently be cheaper. We are not prepared to say that 1cc of the commercial bacterin is sufficient for sheep but it seems that 2½cc would probably be satisfactory for field work.

Summary

An outbreak of blackleg in sheep due to shearing wounds is described. One hundred and forty-five out of a band of 2,000 were lost. The diagnosis was confirmed bacteriologically. Some tests showing the relative value of commercial aggressins and bacterins are presented.

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4. Gas Gangrene Infections of Sheep. Passive Immunization. A. D. McEwen and R. S. Roberts. Jour. Comp. Path. and Therap. Vol. 45, page 212.
5. Blackleg Immunization. Joseph P. Scott. Jour. A.V.M.A. Vol. 80, p. 848.

TABLE V
Experiment IV.—To determine the immunizing value of aggressin and bacterin made by manufacturer number 2.

Sheep No.	Product	Amount	Date of Injection	Amount Culture	Culture Injected	Hours Till Death
1	Aggressin	5cc	9–28–32	2cc	10–24–32	Lived
2	Aggressin	5cc	9–28–32	2cc	10–24–32	Lived
3	Bacterin	5cc	9–28–32	2cc	10–24–32	Lived
4	Bacterin	5cc	9–28–32	2cc	10–24–32	Lived
5	Bacterin	2.5cc	9–28–32	2cc	10–24–32	Lived
6	Bacterin	2.5cc	9–28–32	2cc	10–24–32	47
7	Bacterin	1cc	9–28–32	2cc	10–24–32	Lived
8	Bacterin	1cc	9–28–32	2cc	10–24–32	42
Control				2cc	10–24–32	26

Rattle Snake Bite in the Dog and Cat

By H. W. SAWYER, Daytona Beach, Florida

HAMILTON KIRK[1] states that "cats are immune from snake poisoning." It was decided to challenge this statement. Kirk further states that "the pig and hedgehog share this immunity, although their blood does not contain immune bodies." This seemed to infer that the cat does normally carry anti-bodies in the blood stream against snake venom. Accordingly, it was decided, in case it should be shown that the cat was actually immune to snake venom, to attempt to determine whether such immunity was the result of immune bodies or otherwise, and to ascertain whether such cat blood, or serum, would have any therapeutic value when administered to animals of other species which had received inoculation of snake venom. A further intention was to study the symptoms and necropsy findings of snake-bite in the dog and cat.

According to Stitt,[2] "rattle-snake venom is active chiefly on account of its hemorrhagin, or rather endotheliolysin, which destroys the endothelial lining of the blood vessels. It probably contains a neurotoxin, and it may also contain proteolytic ferments, which may account for the softening of the muscles in snake-bite cases. The toxic effect of the venom takes place without appreciable incubation period, thus differentiating it from other toxins."

Dog No. 1, a mongrel weighing about twenty pounds, was bitten by a large rattle snake (Crotalus spp.), February 5, 1932. The dog was at the time acutely ill with canine distemper. The temperature of the dog before it was bitten was 102° F., the pulse was 100 per minute and the respirations were 25 per minute. The snake inflicted one strike, the blow landing near the middle of the lower lip. This was at 3:48 P. M. At 4:00 P. M. the dog's temperature had risen to 103.4° F., the pulsations were at the rate of 112 per minute and the respirations were accelerated to 35 per minute. The bowels and bladder were effectually evacuated. The dog appeared to be in a dying condition and was extremely weak and depressed. At 4:30 P. M. the temperature was 103.6° F., the pulse was accelerated to 160 per minute and the respirations were 24 per minute. A very slight swelling was noticed at the site of the wound inflicted by the snake. At 5:00 P. M., the temperature was 104.2° F., the pulse was 180 per minute and the respirations were lowered to 18, and were very deep and gasping. The weakness and depression continued as before. At 5:30 P. M. the temperature was still 104.2° F., the pulse had become accelerated to about 204 per minute and was so faint that it could scarcely be felt, and respirations were at the rate of about 20 per minute, still deep and gasping and irregular. In general the animal appeared to be no nearer to, nor yet farther from death than it had been immediately following the bite. At 7:00 P. M., the temperature was 104° F., the pulse had dropped to 188 per minute and the respirations were 24 per minute and of much easier character. The following morning, the dog was still alive and in approximately the same condition as before receiving the bite. This dog later died of the distemper.

Dog No. 2, a mongrel female weighing approximately 20 pounds, was bitten by the same snake about half an hour after dog No. 1 was bitten. The temperature of the dog before it was bitten was 100° F., the pulse was 80 per minute and the rate of respiration was 20 per minute. This dog was bitten at 4:20 P. M. in three places, on the lateral surfaces of the neck, thorax and abdomen. The animal immediately showed symptoms of extreme depression and weakness. The pulse exhibited a marked and rapid increase, becoming too fast and weak to count in about fifteen minutes. The temperature at this time was 102° F., and the

[1] Kirk, Hamilton: Diseases of the Cat, page 3.
[2] Stitt, E. R.: Practical Bacteriology, Blood Work and Animal Parasitology, page 528.

respirations were 14 per minute, extremely gasping and very irregular. At 4:45 P. M., twenty-five minutes after having received the bites, the dog was pronounced dead. Postmortem examination revealed a very slight swelling and hemorrhagic infiltration at the sites of the bite wounds. There was hemorrhage and congestion in all of the internal organs, this being particularly marked in the lungs, which greatly resembled liver in color.

Dog No. 3, a mongrel female weighing approximately 18 pounds, was bitten by the snake on February 27, 1932, 22 days after the first two animals were bitten. The bitch had recently given birth to puppies, and was still in lactation, but was in excellent condition. This dog exhibited the most distinct set of symptoms of any of the animals bitten by the snake. Before being bitten, the temperature was 102.7° F., the pulse rate was 116 per minute and the respirations were 30 per minute. The animal was bitten at 10:40 A. M. in three places; the lateral surface of the thorax, the gluteal region, and the mammary gland. There was an immediate and profuse discharge of mingled milk and blood from the wound in the udder, so that it seemed probable that most or all of the venom injected at this site was immediately eliminated mechanically. Thus it was considered that this dog received only two toxic bites. Evacuation of the bowels and bladder occurred in five minutes after the dog was bitten. In fifteen minutes the dog was in a comatose condition, and there were tetanic convulsions of the extremities. The temperature had at that time risen to 103.2° F., the pulsations were at the rate of 120 per minute, and the respirations were 18 per minute and were extremely deep and gasping. Thirty minutes after the bite was received the temperature had receded to 102.8° F., the heart beat had become accelerated to 220 per minute and was so weak that it had to be taken with a stethoscope, as the pulse could not be felt, and the respirations were at 22 per minute and had become more shallow. There was at this time a relaxation of the extremities. The bitten areas, with the exception of the one in the mammary gland, swelled noticeably but not extensively. Just before death occurred the respirations became very infrequent and extremely gasping. At 11:25 A. M., forty-five minutes after having been bitten, the dog was pronounced dead. Necropsy revealed some swelling and considerable hemorrhagic infiltration at the sites of the wounds in the thorax and buttock, with petechial mottling spreading from the points of entrance of the venom. There was very extreme congestion of every internal organ, the lungs again showing a very marked resemblance to liver in color, and all organs bleeding freely upon incision.

Before the bite:	Temp.	Pulse	Resp.
10:40 a. m.	102.7	116	30
After the bite:			
10:55 a. m.	103.2	120	18
11:10 a. m.	102.8	220	22
11:25 a. m.	Pronounced dead		

Cat No. 1, an adult female of "alley" breed and probably at about the 40th day of gestation was bitten by the same snake March 17, 1932. Before being bitten the temperature was 102° F., the pulse rate was 120, and the respirations were 25 per minute. She was bitten at 9:20 A. M. in two places; the right side and the right hind leg. The pulse and respirations became accelerated quickly, and the cat was soon overcome with a general paresis, remaining recumbent on the left side most of the time. The mouth was held open with the tongue protruding somewhat, and there was a glassy appearance to the eyes. There was early and complete loss of voice. In thirty minutes the temperature was 102.4° F., the pulse rate had become accelerated to 160 per minute, and the rate of respiration had increased to 35, the breathing being shallow. In one hour the temperature was 102.6° F., the pulse had risen to 190 per minute, and the respirations had gone down to 22 per minute, the breathing at that time being deeper and quite labored. In one and one-half hours the temperature was back to 102.4° F., the heart action had increased to 210 and was so weak that the pulse could not be felt and the rate of beat had to be

Before the bite:	Temp.	Pulse	Resp.
9:20 a. m.	102.0	120	25
After the bite:			
9:50 a. m.	102.4	160	35
10:20 a. m.	102.6	190	22
10:50 a. m.	102.4	210	20
11:20 a. m.	102.4	210	20
12:20 p. m.	102.6	216	18
1:20 p. m.	102.6	228	20
2:20 p. m.	102.6	Too fast	12
3:20 p. m.	102.5	to count	15
4:20 p. m.	Pronounced dead		

Cat No. 1.—Table of changes in temperature, pulse, and respirations.

taken with a stethoscope, and the respirations were at the rate of 20 per minute and were deep and gasping. In two hours the temperature, pulse, and respiration had undergone no change. In three hours the temperature was 103.6° F., the heart action had increased to 216 beats per minute, and the respiration were 18 per minute and of the same character as an hour earlier. In four hours the temperature was the same, the rate of heart action had increased to 228 beats per minute, and the respirations were 20 per minute and appeared to be very slightly easier. In five hours the temperature remained the same, and the respirations were at the rate of 12 per minute and were very deep, gasping, and irregular. The heart action from this point forward was too weak and rapid to be counted. At the end of six hours the temperature was 102.5° F., and the respirations were at the rate of 15 per minute and extremely labored. At 4:20 P. M., seven hours after having been bitten, the cat was pronounced dead. There was not at any time any appreciable swelling of the bitten areas. The voice did not return, but attempts to utter sounds appeared to grow somewhat stronger. Postmortem examination revealed precisely the same lesions as shown in the dogs; namely, extreme congestion and hemorrhage of all of the internal organs.

Cat No. 2, a male weighing approximately eight pounds was bitten April 6, 1932. Before being bitten the temperature was 101° F. the pulsations were 116 per minute, and the respiration 26 per minute. The cat was bitten at 9:20 A. M. in three places; in the neck, the shoulder, and the side. The animal showed early symptoms of extreme depression, accelerated heart action and respirations, evacuation of the bowels and bladder, loss of voice, ptyalism, and general paresis. Fifteen minutes after being bitten the temperature was 101.4° F., the pulse was accelerated to 140 per minute, and the respirations were at the rate of 30 per minute. After one-half hour the temperature was 101.5° F., the rate of pulsations was 152 per minute, and the respirations were down to 24 per minute, and were becoming deep and gasping. In forty-five minutes the temperature was down to 101.2° F., the pulse had mounted to 174 per minute, and the respirations had slowed to 18 per minute, and were extremely deep, gasping, and irregular. After one hour the temperature remained the same, the pulse had reached 198 per minute, and the respirations were at the same rate and of the same character as at the previous observation. At 10:30 A. M., one hour and ten minutes after having been bitten, the cat was pronounced dead. Necropsy revealed only the usual lesions.

Before the bite:	Temp.	Pulse	Resp.
9:20 a. m.	101.0	116	26
After the bite:			
9:35 a. m.	101.4	140	30
9:50 a. m.	101.5	152	24
10:05 a. m.	101.2	174	18
10:20 a. m.	101.2	198	18
10:30 a. m.	Pronounced dead		

Cat No. 2.—Table of changes in temperature, pulse, and respirations.

Cat No. 3, a male weighing about 9 pounds, was bitten by the snake April 19, 1932. Before being bitten the cat's temperature was 101° F., the pulse was 120, and the respirations 20 per minute. The cat was bitten at 2:00 p.m., in only one place, the right side of the head. The pulse and respirations showed immediate increase, there was immediate evacuation of the bowels and bladder, the eyes became glassy in appearance, a fairly decided swelling ap-

Before the bite:	Temp.	Pulse	Resp.
2:00 p. m.	101.0	120	20
After the bite:			
2:30 p. m.	101.8	140	30
3:00 p. m.	101.6	156	26
3:30 p. m.	101.6	168	24
4:00 p. m.	101.5	180	16
5:00 p. m.	101.4	184	16
6:00 p. m.	101.4	180	16
8:00 p. m.	101.3	174	18
8:00 a. m.	101.2	148	26

Cat No. 3.—Table of changes in temperature, pulse, and respirations.

peared at the site of the strike, and the cat experienced a loss of voice, although increased attempts to utter sound became apparent as the case progressed. After thirty minutes the temperature was raised to 101.8° F., the pulse was accelerated to 140 per minute, and the respirations were at the rate of 30 per minute. One hour after receiving the bite the temperature was 101.6° F., the pulse rate had increased to 156 per minute, and the respirations had decreased in rate to 26 per minute. After one and one-half hours the temperature remained the same, the rate of pulsations was increased to 168 per minute, and the respirations were at 24 per minute. In two hours the temperature was 101.5° F., the pulse had become accelerated to 180 per minute and was quite weak, and the rate of respirations had decreased to 16 per minute, the breathing being deep and gasping. In three hours the temperature was 101.4° F., the pulse had increased only to 184 per minute, and the respirations remained the same in rate and in character. At the fourth hour the temperature and respirations were as before, and the pulse rate had decreased slightly, to 180 per minute. After six hours the temperature was 101.3° F., the pulse rate was on the down-grade, at 174 per minute, and the respirations were increased slightly in frequency, to 18 per minute, and were much easier. At 8:00 a.m. on April 20, eighteen hours after the infliction of the strike, the cat was still alive and apparently in fairly good condition. The temperature at that time was 101.2° F., the heart action had decreased in frequency to 148 beats per minute, and the rate of respiration was 26 per minute, with the breathing entirely easy and normal. The voice had not been regained. It was at this time deemed unnecessary to keep further tabulations of the temperature, pulse, and respirations, as they had all returned to approximately the normal. The cat was kept under observation for a further period of three days. During that time the comparatively well-marked swelling of the bitten area remained, and the voice failed to return.

Summary

It was surprising to note the almost total lack of local swelling at the site of the wound in practically every case observed. This was in direct contradiction to the popular idea that snake-bite invariably produces an immediate and extensive swelling of the bitten area. It will be noted that in every case the temperature of the bitten animal was not greatly affected. While in one case there was a sudden rise of as much as 1.4° F., in the other cases the temperature was not elevated to that extent during the entire course of the illness, and in every case except the one just alluded to it soon receded to approximately the normal. The pulse, on the other hand, in every case underwent a sudden and distinct acceleration, and continued in the ascent to reach great heights, becoming also extremely weak and small. The respirations in every case underwent a primary quickening, followed shortly by a slowing in the rate which was accompanied by gasping dyspnea. While the dogs all went into a comatose condition, the cats retained their sensibility until the end. In every case the cats suffered an early loss of voice, and even in the case of the cat which did not die after receiving the single bite the voice did not return until four days after the bite was inflicted. This would seem to indicate that one of the first effects of the venom on the cat was neurotoxic, and a similar conclusion might be drawn in the case of the dogs, since they immediately went into a comatose condition. It is quite possible that the dogs may also have suffered a loss of voice similar to that experienced by the cats. Whether or not this

occurred could not be ascertained, due to the fact that none of the dogs made any attempt to bark after being bitten, while every cat made repeated attempts to utter sounds during the period of illness. No softening of the muscles, such as is referred to by Stitt, was observed.

Conclusions

From a consideration of the results of the experiment it is necessary to conclude that the cat is not possessed of an absolute immunity to snake venom. It does appear, however, that it may be possible that the cat enjoys what might be termed a "relative immunity," insofar as the bitten cats required a much greater length of time to die than did the dogs which received the same number of bites. Neither the dog nor the cat which was bitten only once died. The dog that received two bites died in forty-five minutes, and the cat that received two bites lived for seven hours. The dog that received three bites succumbed in twenty-five minutes, while the cat that was bitten three times lived for an hour and ten minutes. In addition to the number of bites received and the length of time required for death to ensue it must be taken into consideration that the cats bitten were in every case less than half the size of the dogs receiving the same number of bites; thus the cats actually received more than double the dose of the dogs. While final conclusions cannot be drawn in regard to the relative size of the dose administered in each bite, it may be safely presumed that this was approximately equal in every case. While it is recognized that it is quite possible for the cats to have received a smaller amount of venom than did the dogs at each bite, it is just as possible that they may have received an even larger dose with each bite than did the dogs. It seems quite apparent that the snake does not discharge all of the venom at the first, or even at the second strike. However, this is only what is to be expected, due to the fact that if, in the wild state, all of the venom were discharged at the first strike the snake would then be left in a defenceless condition until such time as more venom could be produced. The only conclusion that can be drawn as to why the dog and cat that received only one bite failed to succumb is that insufficient venom was inoculated into them in one strike to produce death.

EYE LESIONS AND SYMPTOMS IN DIAGNOSIS

Wittmann, F., 1932. Die Bedeutung der Augenuntersuchung für die Praxis. (The importance of ophthalmoscopy for the practitioner.) Tierärztl. Rundschau 38(14):223-226. Abst. by F. Volkmar.

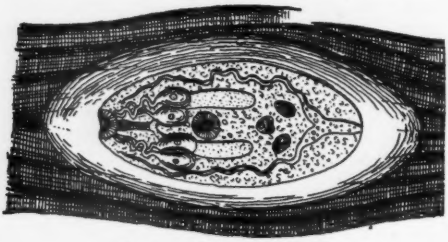
While admitting that the diseases of the eye of domestic animals are of minor importance, the author calls attention to the fact that valuable information can be had from the examination of eyes for diagnosis or differential diagnosis of many diseases. In a large number of infectious diseases the conjunctivae are as a rule characteristically yellowish in color. Paleness indicates anemia. Ptosis is significant for dourine. Prolapse of the membrana nictitans is characteristic for tetanus. Pleuropneumonia, malignant catarrhal fever and hemorrhagic septicemia of cattle are usually accompanied by pseudomembranous adhesions upon the conjunctiva and by keratitis. Cyanosis of the conjunctiva, mydriasis and paretic symptoms are characteristic for anthrax; severe mydriasis and paralysis of ocular muscles is likewise observed in blackleg. Cyanotic conjunctivae in pigs are indicative of erysipelas; in dogs, of distemper. Prolapse of the membrana nictitans, mydriasis, and strabismus in dog are characteristic of rabies. There are likewise specific changes met in the eye in tuberculosis. In fowl-pox the eyes and the infraorbital cavities are the seat of typical diphtheroid lesions. Disturbances of vision are a frequent symptom of many intoxications. Numerous examples are given of the relationship of disease conditions in the eye to diseases of metabolism and to organic diseases. For the proper evaluation of these symptoms, a mastery in the technic of examining the eyes is essential.

Internal Parasites of Swine*

EXPERIMENTAL medicine is the reverse of clinical medicine. That point is worth considering. The two should be correlated. In parasitology but little work has been done on the clinical picture of parasitism. We know that there is an anemia in hookworm infestation and myalgia and fever in trichinosis. For other parasitisms we are generally able to state only that there is a clinical picture of unthriftiness.

The clinician cannot do a great deal to improve our knowledge of the clinical pictures in parasitisms because cases usually come to him as complexes. They are complicated cases of one or more parasitisms and often bacterial infections and certain nutritional ailments as well.

We can diagnose parasitisms by the laboratory method, but it does not tell us a great deal other than that certain parasites are present. We may have parasitisms that are not clinical. We should be able to diagnose parasitisms clinically and to give the owner a better reason for treatment than simply to state that parasites are generally injurious.



Agamodistomum suis.
Fluke encysted in the muscles of swine; enlarged. From Stiles, after Leuckart.

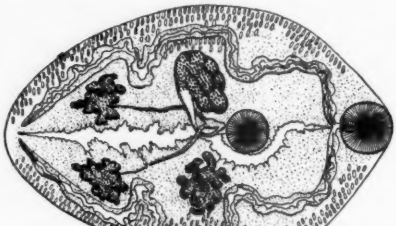
As might be deduced readily from their habits, and particularly from their habits of feeding under domestication, swine are hosts to a great number of internal parasites. The fact that many of these parasites are more plentiful in other animals than in swine, and seem less well adapted to life in the swine host than in various other hosts, might be cited as evidence, if additional evidence were needed, that in the wild state, swine were not scavengers to the extent we find them under domestication, and did not live in the close association with other species that they do now.

Flukes in Swine

Swine are hosts to a long array of flukes. At least 18 different species have been found in swine in various parts of the world. Not all of them, however, have been found in the United States. These flukes, except the first one listed below (muscle fluke) occur also in various other mammals, such as man, sheep, dog and cat, cattle, horse and water buffalo, some occurring in only one or two species, other than swine, and others occurring in several species.

Fasciola hepatica.
The common liver fluke of swine. Ventral view, natural size. From Stiles.

Snails are the intermediate hosts for most flukes. For some, fish appear to be an intermediate host and perhaps other aquatic and semi-aquatic animals also play this role. Of the muscle fluke, the swine is an occasional intermediate host, the primary host being unknown.



Paragonimus westermani.
The lung fluke of swine. Entire worm; ventral view; enlarged. From Stephens, after Leuckart.

The flukes are seldom of material economic importance in swine husbandry, and

* Notes from an address by Maurice C. Hall, Chief, Zoological Division, B. A. I., Washington, D. C., at the Sixth Veterinary Conference, Ohio State University, Columbus, March 18-20, 1931.

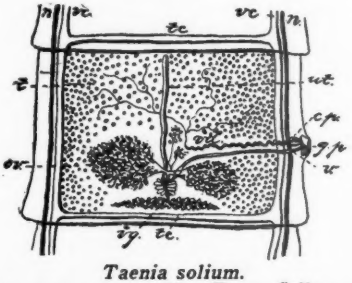
for the purpose of this discussion may be passed with the following listing:

Flukes Infesting Swine

1. Muscle fluke, *Agamodistomum suis,*
2. Common liver fluke, *Fasciola hepatica,*
3. Busk's intestinal fluke, *Fasciolopsis buski,*
4. Lung fluke of swine, *Paragonimus westermani,*
5. Cat liver fluke, *Opisthorchis felineus,*
6. Truncated fluke of swine, *Microtrema truncatum,*
7. Chinese liver fluke, *Clonorchis sinensis,*
8. White liver fluke, *Metorchis albidus,*
9. Roumanian heterophyid, *Loxotrema romanicum,*
10. Swine echinostome, *Euparyphium suinum,*
11. Perfoliate fluke, *Echinochasmus perfoliatus,*
12. Lancet fluke, *Dicrocoelium dendriticum,*
13. Bovine pancreatic fluke, *Eurytrema pancreaticum,*
14. Japanese blood fluke, *Schistosoma japonicum,*
15. Egyptian amphistome, *Gastrodiscus aegyptiacus,*
16. Swine amphistome, *Gastrodiscoides hominis.*
17. Large amphistome, *Cladorchis giganteus,*
18. Rathouis's fluke, *Fasciolopsis rathouisi.*

Tapeworms in Swine

There are no tapeworms known to be normal parasites of swine in the adult stage. Occasionally tapeworms are found in the intestine of swine, but such are always open to the suspicion that swine may have eaten



Taenia solium.
Mature segment. x 10. From Stiles, after Leuckart, cp, cirrus pouch; gp, genital pore; n, nerve; ov, ovary; t, testes; tc, transverse canal; ut, uterus; v, vagina; vc, ventral canal; vd, vas deferens; vg, vitellarium.

sheep intestines containing adult tapeworms a short time previously. It is probable that some tapeworms, so ingested, are capable of living for a short time in swine, but it is doubtful that they are capable of producing mature eggs and perpetuating the species in the intestines of swine.

Swine, however, are the intermediate hosts of a considerable number of tapeworms. The cystic stage of all species given in the following list, excepting only Giard's thysanosome and the Australian anoplocephalid, occur in swine. *Thysanosoma giardi,* a tapeworm of sheep and cattle, has been found rarely and probably accidentally inhabiting the intestine of swine.

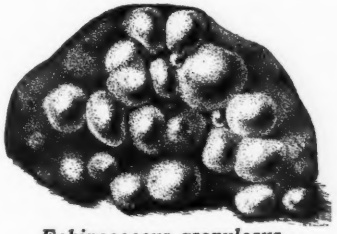
Tapeworms Infesting Swine

1. Manson's bothriocephalid tapeworm, *Diphyllobothrium mansoni,*
2. Raillet's bothriocephalid, *Diphyllobothrium raillieti,*
3. Giard's thysanosome, *Thysanosoma giardi,*
4. Australian swine anoplocephalid, *Paramoniezia suis,*
5. Pork measles, the pork bladder worm, or the armed bladder worm, *Taenia solium,*
6. Thin-necked bladder worm, *Taenia hydatigena,*
7. Gid bladder worm, *Multiceps multiceps,*
8. The hydatid, *Echinococcus granulosus,*
9. Alveolar hydatid, *Echinococcus alveolaris.*

Federal meat inspection, under which 60 per cent or more of the swine in the United States are killed, is a big factor in the control of tapeworms in swine and other

Taenia hydatigena (Cysticercus tenuicollis)
Larva (bladderworm), natural size. From Stiles.

domesticated animals, and it is possible that were all or a large percentage of our swine killed in country slaughter houses, the importance of this animal as an intermediate host for various tapeworms, particularly of man and sheep, might be far greater than it is.



Echinococcus granulosus.
Hog liver infested with hydatids, greatly reduced. From Stiles.

The cystic stage of the foregoing tapeworms are probably of very little or no importance to swine husbandry. They are of

great importance from a public health point of view; particularly is this true of *Taenia solium*.

Nematodes in Swine

From the point of view of swine husbandry, the nematodes are the most important parasites of swine. They also occur in the greatest number of species and individuals, and like other parasites of this animal, the same species is frequently found also in man, and the dog, animals with somewhat similar nutritional requirements and dietetic habits. Some species occur also in other animals with which swine are closely associated.

Although a number of nematodes are common to swine and man, so far as is known, the nematodes of swine as a group are of much less importance to public health than are the tapeworms of swine. Certainly this is true if we except trichina.

The species included in the following list have been found infesting swine in various parts of the world. Not all of them have been reported in swine in the United States, but the majority of them occur in this country as well as elsewhere.

Nematodes Infesting Swine

1. Strongyloides of swine, *Strongyloides suis*, and *S. ransomi*,
2. Strongyloides of man, *Strongyloides stercoralis*,
3. Swine ascarid, *Ascaris suum*,
4. Georgia nodular worm, *Oesophagostomum georgianum*,
5. Short-tailed nodular worm, *Oesophagostomum brevicaudum*,
6. Common nodular worm of swine, *Oesophagostomum dentatum*,
7. Long tailed nodular worm, Oesophagostomun *longicaudum*,
8. Bourgelat's nodular worm, *Bourgelatia diducta*,
9. Globe-headed worm, *Globocephalus longemucronatus*,
10. Connor's globe-headed worm, *Globocephalus connorfilii*,
11. Samoan swine hookworm, *Crassisoma samoense*,
12. Old World hookworm of man, *Ancylostoma duodenale*,
13. American swine hookworm, *Necator suillus*,
14. American human hookworm, *Necator americanus*,
15. Narrow-headed hookworm of dogs, *Uncinaria stenocephala*,
16. Common sheep hookworm, *Bunostomum trigonocephalum*,
17. Kidney worm of swine, *Stephanurus dentatus*,
18. Red stomach worm of swine, *Hyostrongylus rubidus*,
19. Digitate mecistocirrid, *Mecistocirrus digitatus*,
20. Ford's mecistocirrid, *Mecistocirrus fordi*,
21. Common lungworm of swine, *Metastrongylus elongatus*,
22. Salm's swine lungworm, *Metastrongylus salmi*,
23. Short-vagina lungworm of swine, *Choerostrongylus pudendotectus*,
24. Strongyline stomach worm of swine, *Arduenna strongylina*,
25. Toothed stomach worm of swine, *Arduenna dentata*,
26. Six-winged stomach worm of swine, *Physocephalus sexalatus*,
27. Simondsia, *Simondsia paradoxa*,
28. Gullet worm of swine, *Gongylonema pulchrum*,
29. Thorny gnathostome, or swine gnathostome, *Gnathostoma hispidum*,
30. Bauche's filarid, *Filaria bauchei*,
31. Setaria of swine, *Setaria bernardi*,
32. Microfilarid of swine, *Microfilaria sp.*,
33. Giant kidney worm, *Dioctophyme renale*,
34. Whipworm of swine, *Trichuris suis*,
35. Whipworm of ruminants, *Trichuris ovis*,
36. Trichina, *Trichinella spiralis*.

Ascariasis of Swine

Ascaris suum.—There are no constant, dependable morphological differences yet discovered between the ascarid of man (*A. lumbricoides*) and the ascarid of swine (*A. suum*), but present opinion favors the conclusion that they are physiological species with definite host adaptations. However, the swine ascarid is usually smaller, particularly more slender, than the ascarid of man. It differs in infectivity also, *A. lumbricoides* being capable of infesting man at any age, whereas *A. suum*, while it infests pigs readily, affects swine more than four months of age with some difficulty and is present in lower incidence and smaller numbers than in young pigs. *A. lumbricoides* seems to be a natural parasite of man and to have adapted itself rather recently to residence in the hog as a special strain.

Ascaris lumbricoides.
a, male; b, female. Four-ninths natural size. From Neveu-Lemaire.

This parasite of swine is widely distributed in the United States and other parts of the world and frequently occurs in great numbers in the individual. It is the large, thick, yellow or pinkish worm, commonly found in the small intestine of swine at autopsy. It is seen from time to time in the feces of infested animals and in large numbers following the administration of a suitable anthelmintic to infested swine.

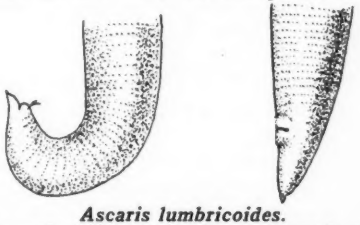
The usual habitat is the small intestine, but when the worms become very numerous in their normal location, some of them wander to other locations and are found in the ducts of the liver and pancreas, and in the gall bladder, esophagus, pharynx, trachea, bronchi and nares. Sometimes, following perforation of the intestine, they are found free in the abdominal cavity.

Veterinarians have given more attention to the ascarid than to any other or all other parasites of swine and more is known concerning its life history, the clinical manifestations of infestation and the means of preventing it than is known concerning any other parasite of swine. It would have taken a very long time and exceedingly acute observation to have discovered the role of the ascarid in thumps in pigs by any but the experimental method. It was very simple that way.

Pathology.—The clinical symptoms caused by large numbers of ascarids in the intestine are not very definitely known. A limited amount of clinical work indicates quite definitely that they cause a general unthriftiness and they are generally credited with the production of more or less enteritis of a low-grade catarrhal nature. Nevertheless, it is an undoubted fact that swine frequently reach the killing floors of packing houses in good flesh and with every appearance of thriftiness, and yet harboring enormous numbers of adult ascaris in the intestines.

In pigs, however, the wandering embryos do cause a very definite pathology, including thumps and pneumonia with a considerable mortality. The most important effect economically is the loss of growth and development in the pigs that survive. Repeated tests have shown that at four months of age heavily infested pigs weigh less than half as much as normal pigs at that age.

Treatment.—Oil of chenopodium in a dose of one dram to the 100 pounds of animal, followed by an adequate purgative, is an effective treatment for ascarid infestation in swine. This is the dose for individual administration. Where oil of chenopodium is given to the herd in slop or feed and we cannot be sure as to the exact amount that each animal will get, the dose must not be larger than one-half dram per 100 pounds of weight; these mass treatments are not very satisfactory.



Ascaris lumbricoides.
Left, male tail, lateral view, enlarged; right, female tail, lateral view, enlarged. From Neumann, after Leuckart.

Do not overlook the necessity of giving an adequate dose of cathartic following the administration of the oil of chenopodium to any animal. Castor oil is a desirable cathartic for the hog, but it must be given in ample dosage. The object is to produce catharsis in the animal and not to give a stated amount of a cathartic to the animal regardless of whether or not the animal is purged.

The oil of chenopodium treatment for ascariasis of swine is very effective. Occasional failures to free the feces of eggs do occur, however. These failures are sometimes due to an occasional female ascarid being lodged in the bile duct, pancreatic duct or ducts of the liver where the oil of chenopodium does not reach it.

Reinfestation with *Ascaris suum* may occur after treatment, of course, from ingestion of eggs, and it may also occur from wandering larvae in the tissues at the time of treatment. It must be remembered that when the ascarid eggs reach the intestinal tract the egg shell is dissolved and the embryo set free. It penetrates the intestinal wall and wanders for a period in various tissues, particularly in the liver and lungs,

returning after a time to the intestinal canal where it develops to maturity and the female commences laying eggs. Although the oil of chenopodium may have removed all of the adult ascarids from the intestines, larvae at the time in the liver, lungs and elsewhere may reach the intestine later and develop there, producing an apparent reinfestation.

Prophylaxis.—The prevention of ascarid infestation of pigs is simply a matter of sanitation. So much has been said and written concerning the McLean County system of swine sanitation that it is not necessary to go into it here, except to say that field tests without number have shown it to be highly profitable to the swine owner, and notwithstanding it is considerable trouble and entails some cost, no swine owner can afford to disregard it.

The swine sanitation project worked out under the direction of the Federal Bureau of Animal Industry in McLean County, Illinois, has had far reaching results. It showed not only that ascarid infestation of swine can be prevented by sanitary measures that are entirely practical, but that a whole group of filth-borne diseases of young pigs are prevented by the same measures. It also indicated that much of our losses among young stock of all kinds may be prevented by giving special care to the young animals and that sanitation is of major importance as a substitute in youth for the acquired immunity to parasitisms and infectious diseases that comes with age.

The present attitude of indifference on the part of the live stock raiser towards the loss of young animals, an attitude that I have denominated the doctrine of infant damnation of live stock, is shown by the McLean County system of sanitation, and by certain work that has been done recently in the rearing of dairy calves under a plan of good sanitation and sensible feeding, to be not only unjustified but highly expensive to our live stock industry.

Nodular Disease of Swine

Oesophagostomum spp.—These are white or grey-brown opaque worms, which as larvae are encysted in the walls of the intestine. The adults live free in the large intestine. They are distributed over a considerable area of the United States. In the southern states we find very severe infestations with various species of nodular worms, resulting in lesions of varying severity up to something resembling the button ulcer of swine pest.

Not much is known concerning the pathology of nodular worm infestation nor is anything of value known as to the treatment. Schwartz of the Zoological Division is investigating these parasites at the present time. The prevalence of the species in the above table, other than *O. dentatum,* is unknown, but some of them appear to be of special importance as nodule producers.

Stephanurus dentatus.
Kidney worm of swine. Entire worms, lateral view. Large illustration, female enlarged. Upper small illustration, male, natural size; middle, female, natural size. From Taylor.

Kidney Worms of Swine

Stephanurus dentatus: The kidney worm of swine is a thick, mottled worm that lives in the abdominal viscera, especially in the leaf lard or kidney fat, the liver, lungs, pleural cavity and lumbar muscles. It is also found under the pleura, in the spleen, portal vein and spinal canal of swine.

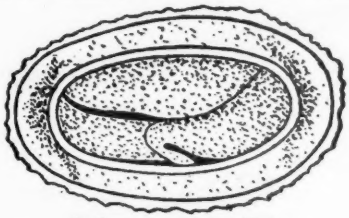
Recent investigations of Nighbert at Moultrie, Georgia, and others have shown this parasite to be responsible for very large losses in districts in the southern states and as the area of infestation is extending all of the time, its economic importance is not yet fully appreciated.

Effective sanitary methods similar to the McLean County system are being worked

out for its prevention. No effective treatment is known for the infested animal.

Stomach Worms of Swine

Hyostrongylus rubidus.—The red stomach worm of swine is a small reddish worm inhabiting the stomach, especially the fundus. It causes a mucous gastritis and is usually found in connection with an excess of thick gastric mucus which may protect it from the effects of anthelmintics.



Arduenna strongylina
Egg. x 1450. From Foster.

It was first observed in this country and has spread to Europe. It is spreading to other countries all of the time. Its life history is direct, there being no intermediate host.

Hyostrongylus rubidus
Left: Egg. x 250. From Marek.
Ancylostoma duodenale
Right: egg; enlarged. From Ward after Parona and Grassi.

No critical experiments have been carried out in the treatment of swine for stomach worm infestation. Unless the mechanical protection afforded by the excessive mucus associated with the worm inhibits anthelmintic action, the use of carbon tetrachloride, tetrachlorethylene or oil of chenopodium should constitute an effective treatment. Preliminary purgation with salts may be of value in removing the protective coating of mucus from the worms and exposing them to anthelmintics.

Arduenna strongylina.—This is another worm inhabiting the stomach of swine. It is located more especially in the pyloric region and in the small intestine.

Another stomach worm of swine, *Physocephalus sexalatus,* also is found in the same locations. The intermediate hosts of this parasite are various beetles (Coleoptera). The worm has a peculiar adaptation in that if the infested intermediate host is eaten by any animal other than a hog, the larvae again encyst themselves instead of developing into adult worms. The re-encysting process continues indefinitely until the animal containing the cysts is eaten by a hog. When this occurs, the larvae develop into adult worms.

Whipworm of Swine

Trichuris suis.—It is not known whether or not the whipworm is harmful to swine.

Filaria bauchei (F. hellemansi)
Eggs, enlarged. From Smit.

We do not know a treatment for whipworm infestation, in fact, we do not know much of anything about whipworms in swine except that they occur.

Trichinosis

Trichinella spiralis.—Trichinae occur in swine, rat and man, and occasionally in the dog and cat and other animals. They are minute worms, the larvae of which encyst in the muscles and cause fever and pain and stiffness similar to the symptoms of rheumatism.

Simondsia paradoxa
Eggs from uterus. X 500. From Railliet, after Cobbold.

Formerly Federal meat inspection included microscopic inspection of export pork for trichina, and of the eight million swine Federally inspected in the United States from 1898 to 1906, when microscopic inspection was discontinued, approximately 2 per cent of the animals inspected were found to be infested.

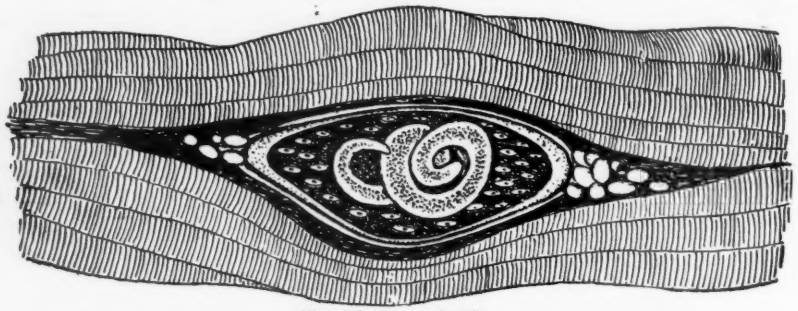
The inspection of export meat for trichina infection was discontinued because Germany insisted on reinspection in that coun-

try. It was never used for pork in domestic trade on account of its cost and because it is not entirely effective in protecting the consumers of raw pork from trichinosis. It is estimated that microscopic inspection of pork for trichinosis would more than double the present cost of all Federal meat inspection.

Trichinella spiralis.
Above, female, enlarged; below, male, enlarged. From Leuckart.

No practical system of inspection has been devised by which persons who eat raw or imperfectly cooked pork can be protected from trichinosis. Adequate cooking offers entire protection against trichinosis in man and the Bureau of Animal Industry carries on an educational program designed to prevent the consumption of raw or undercooked pork products.

So far as swine are concerned, there is no effective treatment for trichinosis. Infestation is prevented by preventing the animals from eating infested flesh. Carcasses of swine dying on farms or elsewhere should be so disposed of that swine cannot eat them or the flesh should be cooked thoroughly before it is fed to swine. The same applies to pork scraps, slaughter house waste and the carcasses of rats. Country slaughter houses where rats abound and where hogs are kept and fed offal from slaughtered hogs are in no small measure responsible for the propagation of trichinosis. The swine sanitation system is probably one of our best control measures for trichinosis, since, properly carried out, it more or less assures that swine are not in a position to eat rats, dead pigs, offal or garbage.



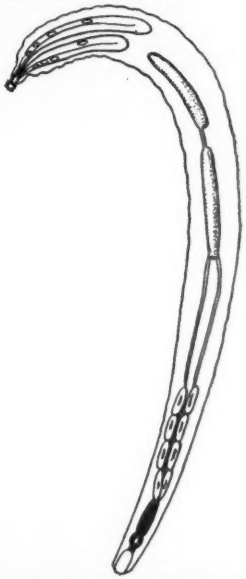
Trichinella spiralis.
Larva encysted in muscle. Enlarged, From Ransom, after Leuckart.

Acanthocephalids Infesting Swine

Macracanthorhynchus hirudinaceus: The distribution of this parasite is world-wide. It possesses considerable economic importance both in this country and elsewhere. It imbeds its head in the wall of the small intestine by means of five rows of well defined projecting hooks and causes a local inflammatory reaction and some necrosis. Probably because of this secure attachment, it has proved resistant to the action of various anthelmintics.

The thorn-headed worms of swine has as its intermediate host various May beetles or June bugs. The anthelmintics tested against this worm have been quite generally ineffec-

tive; the one which has been found fairly effective is deadly to swine. Consequently nothing in the way of treatment can be recommended at this time.



Macracanthorhynchus hirudinaceus.
Thorn-headed worm of swine; adult male, enlarged. From Travassos.

Linguatulids in Swine

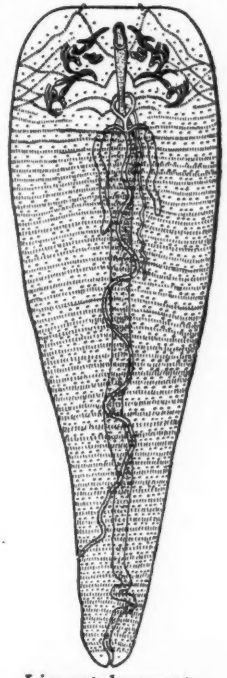
The tongueworms of swine are not true worms, but are degenerated arachnids, relatives of the spiders, ticks and mites. They are commonly regarded as worms and are

Stephanurus dentatus
Left: Egg containing embryo; enlarged. From Taylor.

Gongylonema pulchrum.
Right: Entire worm, natural size. From Molin.

called tongueworms because of their shape. The adults live in the nostrils and the eggs are expelled by sneezing. When the eggs are swallowed by a suitable host, the larvae escape and after wandering widely and molting several times ultimately reach the lungs and the nasal cavity via the bronchi and trachea.

There is no practical treatment for infesation with larval tongueworms. They are practically always discovered postmortem. Irritant inhalations, or other errhines might aid in the removal of adults. The plan doesn't offer a great deal of promise, however.



Linguatula serrata.
Larva from liver of horse. Enlarged. From Fiebiger, after Csokor.

Prevention consists in tanking infested viscera at the time of slaughter.

Two genera of tongueworms as shown below have been described in swine. *Linguatula* has been found in North America in various parts of the eastern portion, especially Georgia. *Armillifer* has been reported from Africa.

Gnathostoma hispidum.
Above: Male. Below: Female, natural size. From Ciurea.

Linguatulids Infesting Swine

1. The tongueworm, *Linguatula serrata.*
2. Braceleted porocephalid, *Armillifer armillatus.*

Guarding Milk Against Lurking Enemies*

By JOHN F. MILLER, D.V.M., Albany, New York
State Department of Health, Bureau of Milk Sanitation

MILK has always been recognized as a desirable and essential food. It is a desirable food because it contains a perfect balance of proteid, carbohydrates and fat, and is easily digestible. Milk is an essential food, especially for infants and young children, because in addition to the above mentioned elements it is the chief source of lime, which is necessary for teeth and bone growth, and it supplies in large amounts the vitamins A, B and G, which are necessary for growth and for health.

There are few food problems which present so many difficulties as that of furnishing to customers at reasonable price a milk that is safe, clean and of good flavor. The conditions surrounding the production and handling of milk subject it to many kinds of bacterial contamination. To reduce this contamination to a minimum should be the aim of every person engaged in the production and distribution of milk.

Bacteria are single cell plants which may be divided into two groups, those that cause disease and those that do not. They grow in any liquid which contains the proper food material, if the temperature is favorable. Milk provides a good medium for the development of most bacteria. Those commonly found in milk multiply rapidly at temperatures between 65° F. and 100° F. As the temperature is decreased, the multiplication becomes slower. At 50° F. growth is slow. Therefore, if the number of bacteria in milk is to be kept low, it is essential that milk be cooled promptly and stored at low temperatures, 50° F. or lower. Generally speaking, the bacteria found in milk are foes to the dairy industry. They sour milk, cause it to become ropy and produce unpalatable flavors and some may cause sickness. Changes occur in milk soon after it is drawn from the udder. These changes are physical and chemical. Most of the chemical changes are due to bacterial action, but these may be prevented if the essential principles of sanitary milk production are fully carried out. Many dairymen are producing and delivering milk with a low bacterial content. This could be the rule if present knowledge on the production of high quality milk were practiced by all dairymen.

As a rule milk contains very few bacteria as it is drawn from the udder. Most of the bacteria in milk come from outside sources. It is known that the largest number is added to the milk from the utensils, such as pails, cans, strainers and milking machines. Contamination from these sources may be reduced to a minimum by first rinsing the utensils with clean, cool or luke warm water and then washing them with warm water containing an alkaline washing powder, using a brush to remove all traces of milk and grease. Avoid washrags and soap. Soap in hard water forms a scum, a sticky, insoluble compound which adheres to the surface of utensils and is difficult to remove. After washing, they should be sterilized. When water is used as a sterilizing medium it should be at or near boiling temperature. When steam is used it should be under pressure, making sure that the utensils are heated until they are too hot to be handled with bare hands.

Many different kinds of bacteria may get into milk from the coat of the cow. The most undesirable ones come from manure, hay and dust. Those from hay decompose protein, often with the production of offensive odors. According to Roseneau their presence in excessive

*Radio broadcast, Sept. 7, 1932.

numbers may cause gastro-intestinal disturbance in children. It is obvious that all cows should be clean at milking time.

Usually flies are found in season wherever milk is exposed. They may carry infectious material to the stable or milk house. During the summer months the danger of contamination by flies is constant. Consequently, all milk and milking utensils should be protected against flies. All openings into the milk room should be screened against flies. The milk room should be kept clean. Keeping the premises clean, especially around the milk house and cow barn, will eliminate many of the breeding places of flies.

While clean milk cannot be said always to be a safe milk in the sense that it is free from disease germs, milk produced by the cleanly dairyman is more likely to be safe than that produced by the dirty one.

A dairy farm and milk plant should be provided with an ample supply of water which is of a safe, sanitary quality. The water supply used should be protected for two reasons: (1) Fecal material may infect the water with bacteria and animal parasites that cause disease of stock or of man. (2) Impure water may carry germs of various sorts and impart bad flavors to milk. If there is any question regarding the water supply on any farm or milk plant the operator should consult the health officer for tests of such water.

Man himself is another source of contamination and sometimes infection of milk through discharges of the nose and mouth and from excreta from the bowels and bladder. Consequently, when handling milk it is very important that the mouth and nose always be covered when coughing or sneezing. Always the hands should be carefully washed after visiting the toilet.

Milkers and other dairy employees should be informed that there is an invisible dirt on the hands which might injure the product, and for this reason it is important that the hands be kept away from milk as much as possible. The practice of milking with wet hands is one that is certain to contaminate milk. It is prohibited in all well regulated dairies. The hands of the milkers should not only be dry but should be clean. It is also important that the hands of all persons handling milk or milking utensils be washed before beginning work.

There is some danger of milk becoming infected with disease germs of animal origin. If the milk is to be consumed raw, it should be produced from cows that are free from bovine tuberculosis, Bang's Disease, and udder inflammation. These diseases may be detected by applying specific tests, the tuberculin test for bovine tuberculosis, the blood test for Bang's Disease, and for mastitis the physical examination of the udder and the color test of the milk are very important. Milk drawn from an inflamed udder may contain excessive numbers of bacteria, some of which may cause serious illness among milk consumers. It is considered good dairy practice to draw the first few streams of milk through a fine wire mesh attached to some receptacle and examine is for flakes or clots, one of the first indications of udder inflammation.

Consult your veterinarian regarding these tests and for additional information regarding animal disease prevention.

No person who is ill should act as a milker or handle milk or milk utensils. A physician or health officer should be consulted to determine if such illness is infectious. Any prospective employee that has suffered from typhoid fever, septic sore throat or scarlet fever should notify the health officer so that it may be determined that he is not a disease carrier before beginning work on a dairy farm or at a milk plant.

In addition to the precautions mentioned above, the pasteurizing of milk is an added safeguard to the milk consumers. In this state milk pasteurization consists of heating milk to 143° F. and maintaining it at that temperature for 30 min-

utes and then cooling it to 50° F. or lower. If pasteurized milk cannot be obtained from dealers, milk may be pasteurized in the home by the following method. The only equipment needed is a double boiler and a glass indicating thermometer.

The milk may be placed in the upper part of a double boiler and the water in the lower, and the milk heated until the thermometer registers 143° F. The milk should be kept at that temperature for 30 minutes and then rapidly cooled to 50° F. or lower by frequently changing the water. It should be kept cold until used. If one does not object to a cooked taste in milk it may be brought to a boiling point and cooled quickly in a closed container.

In conclusion I should like to mention briefly the more important factors relating to prevention of the contamination and infection of milk:

1. All milk cows should be free from disease, and from inflammatory conditions of the udder, and clean at milking time.

2. All persons who come in contact with milk, milking utensils, containers or equipment in any way should be free from communicable disease and not carriers of any such diseases.

3. Only utensils, containers and equipment that are in good repair and have been washed carefully and sterilized should be used for milk.

4. Milk should be cooled promptly to 50° F., kept at that temperature and protected against contamination.

Several bulletins containing helpful information for the milk producer are issued by the New York State Department of Health, including "Milk and Its Relation to Public Health," "The Production and Handling of Milk as It Affects Public Health," and "Rural Water Supplies and Sewage Disposal."

A copy of any or all of these bulletins may be had, upon request, from the State Department of Health, Albany, New York.

TUBERCULIN TESTING

The results of tuberculin testing of flocks of chickens and herds of hogs in LaSalle County, Illinois, were as follows:

Chickens

Flocks tested	652
Clean flocks	245
Infected flocks	407
Chickens injected	147,145
Old chickens injected	43,416
Young chickens injected	103,729
Chickens passed	141,470
Chickens reacted	5,675
Old chickens reacted	5,376
Young chickens reacted	299
Per cent reactors	3.85
Per cent old reactors	12.4
Per cent young reactors	.28
Reactors passed for food	3,823
Reactors condemned	1,519
Not posted, died, etc	333

Swine

Herds injected	189
Clean herds	145
Infected herds	44
Hogs injected	666
Hogs reacted	75
Hogs reacted avian	71
Hogs reacted bovine	4
Hogs reacted both A. and B.	0
Per cent reactors	11.26
Per cent avian reactors	10.66
Per cent bovine reactors	.6

Summary

38 farms where both chickens and hogs reacted.

55 farms where neither chickens or hogs reacted.

88 farms where chickens reacted and no hogs reacted.

8 farms where hogs reacted and no chickens reacted.

Of the 88 farms where chickens reacted and no hogs reacted, 24 had two or less reacting chickens.

All of the swine tested were breeding animals more than one year of age. Of the four animals that reacted to the bovine test, three were on one farm.

H. D. Chamberlain.

Belvidere, Illinois.

What Should Constitute a Satisfactory Bang's Disease Test for Interstate Shipment*

By HERBERT L. GILMAN, Ithaca, New York

THE question of what constitutes a satisfactory test for Bang's abortion disease of cattle for interstate shipment is one of great importance, particularly since so many states have enacted regulations to prevent the importation of cattle affected with this disease. In discussing the problem, we must consider the breeder on the one hand, and on the other hand the necessity for curtailing the interstate spread of a disease of such great economic and public health importance. The requirements should not interfere unduly with the sale of cattle by breeders, yet they should serve the purpose of preventing the spread of the disease. No test for the disease is perfect, even when properly applied and strictly interpreted, but the agglutination test as now used is a highly satisfactory basis for our work in the control of Bang's abortion disease.

The rapid or plate agglutination test has yielded quite satisfactory results, and tests made with it agree very closely with tests made by the tube method. On the other hand, the antigen is subject to rapid deterioration at times and it must be much more accurately standardized than that used for the tube test. The tube test is or should be made under conditions where all factors can be more accurately controlled. This test is also used as the standard of comparison for the rapid method. For these reasons, I believe that it should be chosen for all official tests for interstate shipment and for final state accreditation.

All official tests for this purpose should be made by a competent laboratory under state or federal approval or supervision. All blood samples should be taken within 30 days of the date of shipment of the cattle. It should be requested, but not demanded, that the status of the herd from which the animal came be stated on the report. I also strongly recommend that the agglutination chart showing the exact dilutions used should go with the cow, rather than a mere report of "positive" or "negative." Some states demand a certain titre as a basis for admission of cattle; the breeder makes better use of the charts and is less confused by them when the exact titre is reported and their significance explained by the veterinarian.

While most investigators are in accord as to the technique of the tube agglutination test, there is some difference of opinion as to what constitutes a reaction. One state even goes so far as to require that all imported animals shall be negative to all dilutions, while others are far more liberal in their requirements. Some states have no restrictions on the importation of cattle infected with the disease. Requiring a complete lack of reaction in all dilutions is unduly conservative, and places an unnecessary burden upon the breeder who wishes to sell cattle in that state. It has often happened that too strict regulations are in the end more harmful than those that are too lenient. Our experience in New York State has shown that animals which react not higher than 1:50 seldom are infected or are a factor in the spread of the disease especially when they come from herds containing no animals with a higher titre than this. Animals with a complete reaction at 1:100 or higher are considered definitely infected and must be classed as potential spreaders of the disease. It

*Presented at the Third Annual Eastern States Conference on Bang's Disease, Trenton, New Jersey, November 9, 1931.

seems that excluding cattle showing agglutination at 1:50 or lower is unnecessarily stringent. After all, much depends on our proper interpretation of the test. The animal agglutinating at 1:50 from a herd known to have been free from the disease for some time is a far more desirable individual than a non-reactor or one with a titre of 1:25 that has been picked at random from a positive herd or one of unknown status. In our experience in New York State any attempt to control the disease in a herd by rejecting animals with a titre of 1:25 or 1:50 would render our efforts entirely ineffective. All of our non-infected herds have many animals in them which vary from negative to positive at 1:50. Judging from reports, our experience agrees with that in most states. These requirements have stood the test of time in a large number of herds. These same requirements should be just as satisfactory for interstate shipment if we will stress the necessity of knowing not only the titre of the cow but also the status of the herd from which the animal comes.

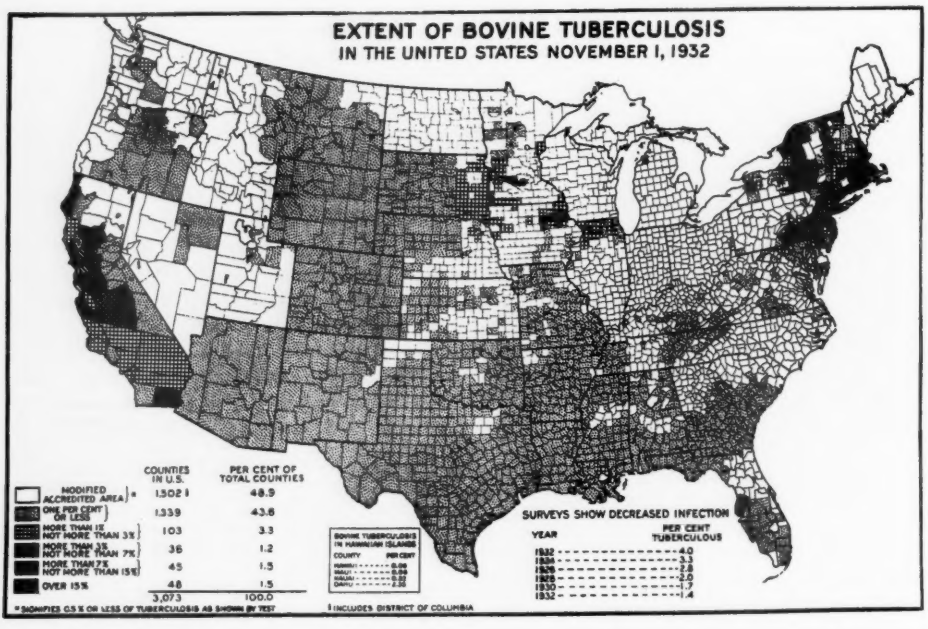
In summarizing, I might say that:

1. The tube test conducted under state or federal supervision or approval should be the standard test for interstate shipment.

2. No animal should be accepted for interstate shipment if her blood shows any agglutination in dilutions higher than 1:50.

3. The agglutination chart showing the dilutions set and the reaction in each should accompany the animal.

4. It is strongly recommended that the status of the herd from which the animal comes should be stated on the chart.


EXTENT OF BOVINE TUBERCULOSIS
IN THE UNITED STATES NOVEMBER 1, 1932
COUNTIES IN U.S.
PER CENT OF TOTAL COUNTIES
MODIFIED ACCREDITED AREA* 1,502 ‡ 48.9
ONE PER CENT OR LESS 1,339 43.8
MORE THAN 1% NOT MORE THAN 3% 103 3.3
MORE THAN 3% NOT MORE THAN 7% 36 1.2
MORE THAN 7% NOT MORE THAN 15% 45 1.5
OVER 15% 48 1.5
3,073 100.0
BOVINE TUBERCULOSIS IN HAWAIIAN ISLANDS
COUNTY PER CENT
HAWAII 0.09
MAUI 0.08
KAUAI 0.32
OAHU 2.30
SURVEYS SHOW DECREASED INFECTION
YEAR
PER CENT TUBERCULOUS
1932 4.0
1884 3.3
1909 2.8
1928 2.0
1930 1.7
1932 1.4
* SIGNIFIES 0.5 % OR LESS OF TUBERCULOSIS AS SHOWN BY TEST
‡ INCLUDES DISTRICT OF COLUMBIA

The white portions of the map are modified accredited areas, signifying 0.5 per cent or less of tuberculosis among cattle, as shown by tuberculin tests. On November 1, 1932, the modified accredited areas included 1,502 counties, parts of 1 county, and 65 towns in Vermont. Counties thus far classed as modified accredited areas constitute approximately 49 per cent of all the counties in the United States. In addition, area work is in progress in 316 other counties. The development portrayed on this map has occurred since July, 1923, when 17 counties in 4 states were designated as the first modified accredited areas

THE PLACE OF MILK IN THE DIET

The scientific investigations of milk that have been made in the past three decades have all demonstrated that it plays an essential rôle in the human dietary and is of particular benefit to the very young. Furthermore, they have also furnished an explanation of the esteem in which milk and its products have been held by the human race since the dawn of civilization.—Connecticut Agricultural Experiment Station Bulletin No. 340, July, 1932.

POISONING OF HORSES BY CARBON TETRACHLORIDE*

In the experiments described, the following symptoms of intoxication had been diagnosed: Apathy, anorexia, polydipsia, tussis, icterus, colic, diarrhea, albuminuria, tremor, swellings, sensations of pain; variation in temperature, variation in frequency of pulse and respiration. The symptoms persisted up to 10 days and did not depend on the amount of CCl_4 given. The decrease of the blood calcium level after a dose of CCl_4 was likewise independent of the amount of CCl_4 given. The symptoms of intoxication coincided with the decrease of the blood calcium level, but were independent of the degree of decrease. Vitakalk, when fed before the administration of CCl_4, lessened the decrease of the bloodcalcium level, but had no influence upon the severity of the intoxication. Chlorcalcium-starch prevented the decrease of the bloodcalcium level but did not prevent symptoms of intoxication. Vitamin-yeast exposed to ultraviolet rays lessened the decrease of the bloodcalcium level and the duration and severity of the symptoms of intoxication. A delayed sedimentation velocity of the erythrocytes and an increase in the resulting sediment has been observed in a majority of the cases.

*Pelckmann, Kuno. 1930. Ueber tetrachlorkohlenstoffvergiftungserscheinungen bei Pferden, deren Zusammenhang mit dem Blutserumcalciumspiegel und über Versuche, die Vergiftungserscheinungen durch Erhöhen des Bluekalkgehaltes abzuschwächen. (Intoxication of horses from CCl_4, its relation to the bloodserumcalcium level and experiments to counteract the effects of poisoning by raising the bloodcalcium level.) Arch. Tierheilk. 62(1):1-76. Abst. by F. Volkmar.

LIVE-STOCK REMEDIES

In the enforcement of the Federal food and drugs act, this Department has tested a number of preparations now on the market which contain various combinations of kamala and nicotine sulphate and also iodine products. Government tests showed definitely that these types of preparations, although labeled as being effective for roundworms and tapeworms in chickens and turkeys, are not effective in expelling any species of tapeworms which commonly infest chickens and turkeys nor any species of roundworms other than the large roundworm (ascaridia). It is therefore the duty of this Department, in the enforcement of the food and drugs act, to remove from interstate channels products of this character if labeled as expellers or controls for tapeworms and roundworms other than the large roundworms (ascaridia).

The Food and Drug Administration has on numerous occasions advised manufacturers of worm remedies that no label claims should be made for any species of worms which infest poultry or other animals unless such claims are based on adequate critical tests conducted by those who are competent to carry on such investigations and able properly to interpret their results. Efficacy claims made for worm expellers or worm remedies, if based solely on clinical observations, are not considered justified by authorities on veterinary parasitology. Unless a product can be depended upon, when used as directed, to remove the worms—including the heads of tapeworms—for which the article is recommended in the labeling, the drug product is misbranded under the Federal food and drugs act.

The addition of drugs known to have anthelmintic properties in mineral mixtures, stock powders, so-called "conditioners" and tonics, has not proved effective in the control of worm infestation of live-stock. Mixtures of this character, labeled for the control of worm infestation, are considered grossly misbranded.

W. G. Campbell,
Chief, Food and Drug Administration.

A Labor Saving Method of Rabbit Husbandry

By F. G. STEINBACH, Wildwood Crest, New Jersey

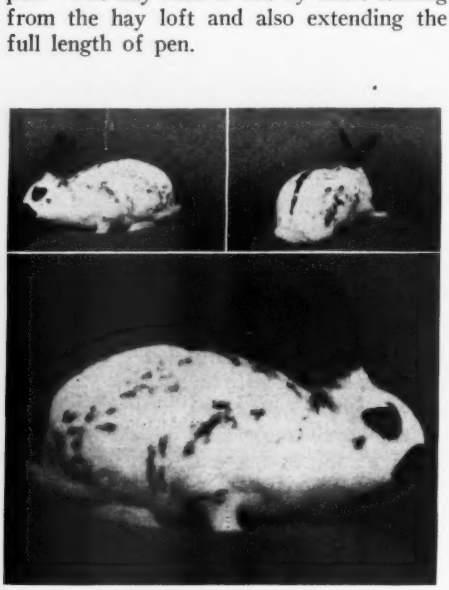
INSTEAD of the usual daily rations of grain and hay method of rabbit management with wire floors, I have found a system that enormously reduces labor.

By keeping up the blood calcium it is possible to:

1. Hay once a year.
2. Grain once a month.
3. Clean pens once a year (beside removing wet or damp litter from one corner three or four times a year).

In some of my pens I have litter that has been used for 18 months and the only odor is that of the fragrance of the hay.

The pens are constructed so the animals in upper pen draw the hay through inch-mesh poultry wire which constitutes the floor of the hay loft. The animals in the bottom pen draw their hay through an inch-mesh wire rack extending the full length of pen. The hay rack is fed by shaft leading from the hay loft and also extending the full length of pen.



English Spots

This shaft also serves the purpose of allowing an exit for the hot air in summer from both top and bottom floors and the loft protects the second floor from the heat of the sun on the roof. The floor of each compartment is covered with four to six inches of peat moss litter.

There have been no sore hocks or coccidiosis or cases of depraved appetite in my rabbitry. I have been called to rabbitries which were suffering loss from coccidiosis in spite of wire floors. Coccidiosis control is not so much a matter of sanitation as of keeping up the health and resistance of the animals.

Breeding the does more than three times a year and allowing them to rear more than six young to the litter, is a common cause of lowered resistance.

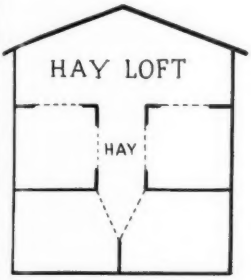
Legume hay is the chief source of calcium for herbivorous animals and is essential to prevent acidosis in pregnant or lactating females and their young. Having legume hay before the rabbits at all times prevents the sequels of low blood calcium, one of which is depraved appetite. Depraved appetite manifests itself in fur eating and manure eating. Indigestion from overeating of grain is avoided by ample legume hay which keeps the animals employed and contented.

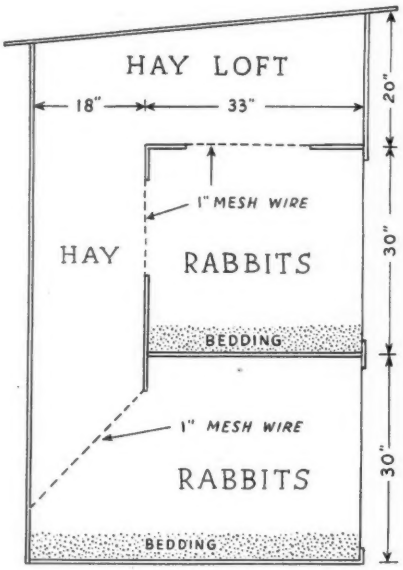
The grain is fed in hoppers. Feed only whole grain. Choice of grain should depend upon price. Unlike horses, rabbits tolerate wheat well. At present I am feeding a very good quality of whole corn which I buy retail at $1.05 per hundred. The cost of pellets is prohibitive.

There are several reasons for preference for whole grain: 1, Cheaper; 2, it keeps much better and retains its vitamine content longer than crushed or cracked grain; 3, the quality can be judged more readily; 4, vitamine E is found in whole grain, and the absence of this vitamine is a cause for ster-

ility; 5, whole grain cannot be disguised or diluted with sweepings, dirt, etc.

The animals I have worked with are English spots.





Rabbit Pens, end view. These pens are six feet long. The bottom pens are wider and contain more room than the upper pens and can be used for youngsters after weaning. The upper pens are for breeders. All pens are open front. The wire floor of the loft can be sloped down at one end of the upper pen so that young rabbits may reach the hay as soon as they come out of the nest. The figure on the left shows pens on two sides with a hay chute in the middle.

Watering on a commercial scale can be done by long galvanized gutters in which the depth of the water is regulated by a float valve.

On a small scale, galvanized fluted pans will serve the purpose. The water can be changed twice a week. A ten inch pan four inches deep will be heavy enough to prevent tipping over. The fluted, sloping sides will permit bursting from expansion on freezing. Large stone crocks are too heavy to handle. In winter rabbits can lick ice and watering once a week is all that is necessary. They should have access to water or ice at all times, summer and winter.

Green food like grass, etc., can be fed *ad libitum*. Very succulent greens such as lettuce, etc., should be fed with caution.

The above method of management keeps my rabbits in fine condition. If a doe that is too fat fails to "settle," put her in a pen next to a buck with only a wire partition between. Feed her only hay and no grain until she is pregnant. Expose her daily until she accepts service.

CHANGES IN BLOOD OF NEWBORN*

In the animals investigated, the bloodpicture exhibited a distinct change during the period immediately following birth. The change consisted of a neutrophilia complicated with a shift to the left (anisocytosis), depending in its degree of severity upon the character of the bloodpicture of the animal species under consideration. The changes are most pronounced shortly after birth, followed by a reduction of the neutrophiles, often below normal values. Just previous to the termination of the nursing period, another shift in the bloodpicture, consisting of a neutrophilia, is encountered in practically all the animal groups. Since these changes are not temporary, but continue for a certain period of time, the author sees in this phenomenon a biological law.

*Klein, Th. 1932. Untersuchungen über die Linksverschiebung im Blutbilde von neugeborenen Säugetieren. (Investigations concerning the shift to the left in the bloodpicture of new-born mammals.) Folia Haematologica 46(3):198-225. Abst. by F. Volkmar.

High Lights of the Work of the Bureau of Animal Industry, Fiscal Year 1932

Radio Address by J. R. MOHLER, Washington, D. C.

IN SAFEGUARDING animal health, the bureau's quarantine service was successful in excluding all foreign livestock plagues—except one brief invasion of foot-and-mouth disease. This is one of the most infectious diseases known to science. Last April the malady appeared mysteriously in a herd of 4,000 garbage-fed hogs in southern California. But experience in former outbreaks had taught the value of prompt action. The state, local and federal veterinary forces, working together, began to suppress this disease immediately after its diagnosis and fortunately were able to stamp out the infection in the record time of 10 days.

This country is fortunate also in the steady eradication of bovine tuberculosis. Last year the official veterinarians engaged in this work tested more than 13 million cattle—an average of more than a million a month. Altogether about a quarter of a million cattle proved to be tuberculous. They were promptly removed and slaughtered. The tuberculosis-eradication campaign has materially reduced the menace of tuberculosis to human and livestock health. I congratulate every owner of a tuberculosis-free herd, and every other supporter of the work on the progress made.

About 6,500 outbreaks of hog cholera—an average of about 18 a day—occurred during the year covered by this summary. The number was about twice that of the year before in spite of the well-known methods of prevention and control. This situation indicates a gambling spirit among some of my good friends who are otherwise conservative. Taking chances with hog cholera is likely to cost as much as looking into a gasoline tank with a match. Serum this year is better than ever before, as a result of research and refinements in methods of production. Serum is also lower than usual in price. The Bureau of Animal Industry has assigned to duty in the important hog-raising states one or more trained veterinarians to investigate outbreaks of hog cholera, hold autopsies, and otherwise aid hog growers and veterinary practitioners in keeping the cholera menace in check. I suggest that every hog grower will benefit by cooperating fully in these efforts to reduce cholera losses.

Practically all stockyard companies have made substantial reductions in feed charges which are already resulting in material savings to livestock producers. At several markets, schedules of lower commission rates also have been put into effect with prospective savings of more than a million dollars a year to producers who patronize those markets. The lower rates are partly the result of orders issued by the Secretary of Agriculture, following formal hearings, and partly through voluntary action by commission men subject to the packers and stockyards act.

An experiment with hogs showed that sows reached their greatest efficiency in pig and pork production when between two and three years old. This is something to keep in mind when selecting breeding stock. Research with wool resulted in a simplified method of measuring the clean-wool content in fleeces and also in a rapid test for the fineness of wool. These experiments and discoveries are typical of scores of others that have a practical bearing on the earning power of farm animals and the value of their products.

Our experimental work deals also with poultry. We are studying how to improve the fertility and hatchability of eggs, methods of incubation, brooding, compounding of rations—in short, finding new ways of reducing losses and increasing net returns.

Achievements in Disease Control

RESULTS of the work of the Federal Bureau of Animal Industry in combating animal diseases, in inspecting meats, and in improving livestock-production methods through experimentation and research are presented by Dr. John R. Mohler, chief of that bureau, in his annual report, for the fiscal year ended June 30, 1932, which Arthur M. Hyde, Secretary of Agriculture, made public recently.

Bovine tuberculosis was practically eliminated during the year from four states—Wisconsin, Ohio, Idaho, and North Dakota—says the report. Not more than two states had achieved this goal in any previous year. Veterinarians tested approximately 13,400,000 cattle, of which 250,000 were found to be tuberculous. The states and Federal Government cooperate in this work.

In the southern states the Bureau of Animal Industry, in cooperation with state officials and cattle owners, conducted nearly 23 million dippings or inspections of cattle, horses, and mules in the eradication of the cattle tick which transmits tick fever. The area freed of ticks during the year exceeded 16,000 square miles.

In hog cholera control, bureau veterinarians investigated 6,480 outbreaks of hog cholera, which involved 3,722 autopsies and visits to nearly 25,000 premises. Bureau employees also supervised the manufacture, in federally licensed establishments, of more than a billion cubic centimeters of anti-hog-cholera serum. This product is the country's principal protection against hog cholera. Production of serum was 31% greater than during the previous year.

In the eradication of sheep scabies, bureau inspectors supervised more than 3 million dippings and made nearly 20 million inspections. Affected sheep were only about 40% as many as last year. Progress was made also in eradicating cattle scabies. Only about 75% as many affected cattle were found as in the previous year.

A campaign against liver-fluke infection in sheep in California, based on the bureau's research, has almost eradicated the infection and the campaign was extended to other western states.

John R. Mohler

As a further means of safeguarding livestock health, bureau employees inspected approximately 17 million cattle, 30 million sheep, and 25 million hogs at market centers from which animals are shipped for feeding and breeding purposes. Of these nearly 700,000 were dipped, immunized, or otherwise treated to comply with regulations. The stockyards work also involved supervision of the disinfection of more than 17,000 livestock cars.

The dreaded foot-and-mouth disease appeared in California last spring. Federal, state, and local veterinary officials succeeded in stamping it out in 10 days, setting a new record for speedy eradication.

Federal inspection of meat included post-mortem examinations of more than 77,000,000 food animals in 799 establishments in 269 cities and towns.

Investigations of infectious abortion, one of the most costly livestock diseases, confirmed previous evidence that the eye and skin may be important channels by which the disease may infect animals. Experiments with vaccines of low virulence and also the use of vaccines during calfhood indicate that these methods of combating the disease can be made to serve a useful purpose in handling badly infected herds.

Review of Dogs in 1932*

By WILL JUDY

THE year 1932 may not be recorded as an outstanding dramatic year in dogs in America, but it has had one distinguishing feature. Notwithstanding the depressed business conditions everywhere, the professional dog business has not suffered nearly as much as other business activities. Sales prices have been reduced to about 40% from those of three years ago, but the total number of sales is practically the same as in other years. This would indicate that America has become dog-conscious and that the dog as an investment in companionship, guard and usefulness, will not be sacrificed easily.

A few dog clubs did not hold their shows on account of business conditions, and for these we can not have praise. The total number of shows has been just as large as in 1931. Westminster as usual, led in number of dogs entered—2,250 against 2,550 in 1931.

Perhaps the outstanding event of the year was the change in American Kennel Club officers and the complete revision of the by-laws and rules, which changes are not yet finally acted upon, but likely will be adopted in entirety soon. The American dog fancier can look forward to a leadership free from secrecy, dictatorial methods and personal animosities.

A very refreshing observation is that registrations have suffered little. For the first eight months ending with August, the total was 29,800 against 29,000 for the corresponding period last year.

The adoption of the litter registrations effective for puppies whelped on or after January 1, 1932, is a basic change. However, the rule that only one of two persons, either the breeder or the party to whom he sells the puppy can register an individual puppy, is a strange rule which will work hardship and will reduce in time, the number of registrations.

Very little trouble has been caused by rabies quarantine and it would appear the epizootic of several years ago has subsided. Distemper has been lessened considerably by the increasing use of serum. Running fits still continue a common canine ailment whose nature and cure have not yet been determined.

There has been a steady change in registration popularity. The shepherd, leader for years, is down to about eighth place. The Bostons lead very nicely as they have for two years, but Scotties, cockers and springers have moved up considerably toward the top. Minor breeds which have shown decided gains are dachs, danes, dobermans and Irish setters.

The United States Kennel Club organized as a rival to the American Kennel Club has made little headway. Some dog publications have fallen by the wayside and others have taken their places. About the only section of the country which is now disturbed by club differences is California, which has been busy lately with charges and counter charges.

National Dog Week in 1932 was a decided success and the newspapers of the country gave it much publicity. This movement seeks to unite all dog clubs and individuals in one national effort each year to bring dogs to the attention of the public.

All in all, 1932 has been an interesting year, with some old timers dropping out, but just as many or more newcomers taking their places in the ranks. It can be said that good sportsmanship was prevalent and that in the matter of judging, sales and registrations there were very few complaints.

As we continue in the dog field, we become more enthusiastic, more satisfied with its sportsmanship, its ethics and its hopes for the future. We close our review with the salutation: "Hail to 1933—may it be America's best year in dogs."

*Editorial from the Souvenir December 1932 issue of Dog World.